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BiPAP® Synchrony™ Provider Manual

BiPAP systems are the subject of one or more of U.S. Patents #5148802, #5239995, #531937, #5433193, Canadian Patent #2, 024, 477, European Patent #EP0425092, German Patent #69021681.5-08, and other pending U.S. and foreign patents. BiPAP is a registered trademark of Respironics, Inc.

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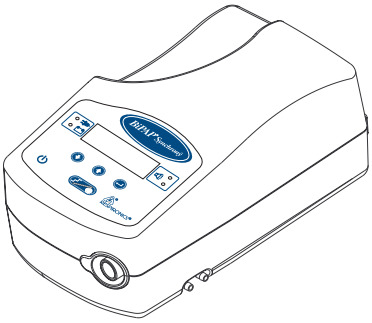
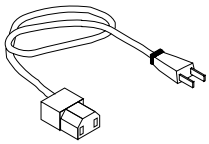
- BiPAP Synchrony
- power cord
- flexible tubing (1.8 m x 2 mm I.D.)
- filter cap
- pollen filters
- ultra-fine filter
- optional modem cable (4.27 m)
- User Guide*



BiPAP Synchrony



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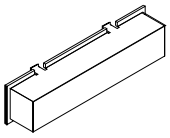
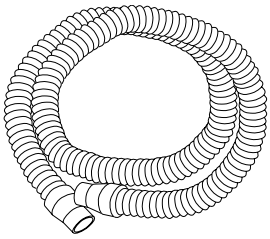


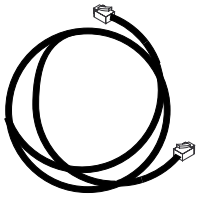
Filter Cap



Flexible Tubing

Ultra-fine Filter

Pollen Filters



Optional Modem Cable

User Guide*

* Not included with all models.

Chapter 1: Warnings and Cautions

WARNING: Indicates the possibility of injury to the patient or the operator.

CAUTION: Indicates the possibility of damage to the device.
CAUTION! US federal law restricts this device to sale by or on the order of a physician.

NOTE: Places emphasis on an operating characteristic.

1.1 Warnings

- This manual serves as a reference. The instructions in this manual are not intended to supersede the health care professional's instructions regarding the use of the Synchrony.
- The operator should read and understand this entire manual before using the Synchrony.
- The Synchrony provides positive pressure ventilation and is indicated for assisted ventilation. The Synchrony does not provide ventilation with guaranteed tidal volume delivery. Patients requiring ventilation at predetermined tidal volumes are not candidates for pressure support ventilation.
- The Synchrony should be used only with masks and connectors recommended by Respironics or with those recommended by the health care professional or respiratory therapist. See Chapter 12 for approved patient circuits. A mask should not be used unless the Synchrony is turned on and operating properly. The exhalation port(s) associated with the mask should never be blocked.

  Explanation of the Warning: The Synchrony is intended to be used with special masks or connectors that have exhalation ports to allow continuous flow of air out of the mask. When the Synchrony is turned on and functioning properly, new air from the Synchrony flushes the exhaled air out through the mask exhalation port. However, when the Synchrony is not operating, enough fresh air will not be provided through the mask, and exhaled air may be rebreathed. Rebreathing of exhaled air for longer than several minutes can in some circumstances lead to suffocation.
- In the event of a power or device failure, audible and visual alarm signals will activate. The Synchrony must be disconnected from the patient immediately. As is the case with most ventilators with passive exhalation ports, when power is lost, sufficient air will not be provided through the circuit and exhaled air may be rebreathed.
- At low EPAP pressures, the flow through the exhalation port may be inadequate to clear all exhaled gas from the tubing. Some rebreathing may occur.
- If supplemental oxygen is added to the breathing circuit, the optional oxygen valve must be installed and used as shown in Chapter 10. The valve automatically stops the flow of oxygen when the blower is off.
- If oxygen is used with the Synchrony, the oxygen flow must be turned off when the Synchrony is not operating.

  Explanation of the Warning: When the Synchrony is not in operation, and the oxygen flow is left on, oxygen delivered into the ventilator tubing may accumulate within the Synchrony's enclosure. Oxygen accumulated in the ventilator enclosure will create a risk of fire.
- Oxygen supports combustion. Oxygen should not be used while smoking or in the presence of an open flame.

Warnings (continued)

- When administering fixed-flow supplemental oxygen, the oxygen concentration may not be constant. The inspired oxygen concentration will vary, depending on the IPAP and EPAP settings, patient breathing pattern, and the leak rate. Substantial leaks around the mask may reduce the inspired oxygen concentration to less than the expected concentrations shown in Chapter 10. Appropriate patient monitoring should be used.
- Operation of the Synchrony may be adversely affected by

  —electromagnetic fields exceeding the level of 10 V/m in the test conditions of EN 60601-1-2

  —the operation of high frequency (diathermy) equipment

  —defibrillators, or short wave therapy equipment

  —radiation (e.g., x-ray, CT)

  —magnetic fields (e.g., MRI).
- The Synchrony is not suitable for use in the presence of flammable mixtures such as gases, anesthetics and liquids.
- Do not use the Synchrony at room temperatures above 35°C. If the Synchrony is used at room temperatures above 35°C, the temperature of the airflow may exceed 41°C, which could cause thermal irritation or injury to the patient's airway.
- Do not operate the Synchrony in direct sunlight or near a heating appliance because these conditions can increase the temperature of the airflow delivered to the patient.
- To reduce the risk of contamination, a low resistance main flow bacteria filter may be placed in-line between the Synchrony and the patient.
- The Synchrony does not have an alarm to detect occlusion of the exhalation port. Before each use, inspect the patient circuit to verify that the port is not occluded. Occlusion or partial occlusion can reduce airflow and result in rebreathing of exhaled air.
- Do not use antistatic or electrically conductive hoses or tubing with the Synchrony.
- When the Synchrony is used with a humidifier, position the humidifier such that the water level in the humidifier is lower than the patient, and the humidifier is on the same level or lower than the Synchrony.
- If you detect any unexplained changes in the performance of the Synchrony, if the Synchrony is dropped or mishandled, if water is spilled into the enclosure, or if the enclosure is broken, seek the assistance of Respironics or an authorized service center.
- Repairs and adjustments must be performed by Respironics or an authorized service center. Service done by inexperienced or unqualified personnel, or installation of unauthorized parts could cause injury, invalidate the warranty, or result in costly damage.
- Electrical cords and cables should be periodically inspected for damage or signs of wear.
- To avoid electrical shock, unplug the Synchrony before cleaning it.
- Verify the operation of the patient disconnect alarm with any changes in the patient circuit.

Warnings (continued)

- Verify that the Patient Disconnect alarm is active if required for medical reasons.

1.2 Cautions

- The Synchrony may only be operated at temperatures between 5°C and 35°C.
- Do not immerse the Synchrony or allow any liquid to enter the enclosure or the inlet filter.
- Condensation may damage the Synchrony. Always allow the Synchrony to reach ambient temperature before use.
- Use the AC cable retainer to keep the AC power cord from falling out.

Additional Warnings, Cautions, and Notes are located throughout this manual.

1.3 Intended Use

The Synchrony is intended to provide noninvasive ventilation in adult patients (>30 kg) for the treatment of respiratory insufficiency (a condition in which the patient can continue without ventilation for some period, such as overnight) or obstructive sleep apnea. The Synchrony may be used in the hospital or home.

The Synchrony is intended for use with nasal masks and full-face masks as recommended by Respironics.

WARNING! Do not connect any equipment to the Synchrony unless recommended by Respironics or the health care professional. Verify that an exhalation port is present to exhaust CO_2 from the circuit. If circuit accessories other than those recommended by Respironics are connected to the Synchrony, then pressures must be verified. Use of these accessories may alter the pressure received, reducing the effectiveness of treatment.

1.4 Contraindications

The use of the Synchrony is contraindicated on patients without a spontaneous respiratory drive.

The use of the Synchrony for noninvasive positive pressure therapy may be contraindicated on patients

- unable to maintain a patent airway or adequately clear secretions,
- at risk for aspiration of gastric contents,
- with acute sinusitis or otitis media,
- with a history of allergy or hypersensitivity to the mask materials where the risk from allergic reaction outweighs the benefit of ventilatory assistance,
- with epistaxis, causing pulmonary aspiration of blood, or
- with hypotension.

NOTE: When assessing the relative risks and benefits, the health care professional should understand that the Synchrony can be set to deliver pressures up to 30 cm H_2O. Also, in the unlikely event of certain fault conditions, a maximum static pressure of 40 cm H_2O is possible.

1.5 Patient Precautions

- Advise the patient to immediately report any unusual chest discomfort, shortness of breath, or severe headache.
- If skin irritation or breakdown develops from the use of the mask, refer to the mask instructions for appropriate action.
- The following are potential side effects of noninvasive positive pressure therapy:
  - —ear discomfort
  - —conjunctivitis
  - —skin abrasions due to noninvasive interfaces
  - —gastric distention (aerophagia).

1.6 Communication Statements for Optional Modem

NOTE: An optional internal modem is available in models of the Synchrony sold in the United States and Canada. If your model does not have this feature, you can connect the Synchrony to an external modem. The following statements apply to use of the Synchrony with a modem through U.S. telephone lines.

TYPES OF SERVICE

The Synchrony optional internal modem is designed to be used on standard device telephone lines. It connects to the telephone line by means of a standard jack called the USOC RJ-11C (or USOC FJ45S). Connection to telephone-company-provided coin service (central office implemented systems) is prohibited. Connection to party lines service is subject to state tariffs.

TELEPHONE COMPANY PROCEDURES

The goal of the telephone company is to provide you with the best service it can. In order to do this, it may occasionally be necessary for them to make changes in their equipment, operations or procedures. If these changes might affect your service or the operation of your equipment, the telephone company will give you notice, in writing, to allow you to make any changes necessary to maintain uninterrupted service. In certain circumstances, it may be necessary for the telephone company to request information from you concerning the equipment that you have connected to your telephone line. Upon request of the telephone company, provide the FCC registration number and the ringer equivalence number (REN); both of these items are listed on the equipment label. The sum of all the RENs on your telephone lines should be less than five in order to assure proper service from the telephone company. In some cases, a sum of five may not be usable on a given line.

IF PROBLEMS ARISE

If any of your telephone equipment is not operating properly, you should immediately remove it from your telephone line, as it may cause harm to the telephone network. If the telephone company notes a problem, they may temporarily discontinue service. When practical they will notify you in advance of the disconnection. If advance notice is not feasible, you will be notified as soon as possible. When you are notified, you will be given the opportunity to correct the problem and informed of your right to file a complaint with the FCC. Contact your telephone company if you have questions about your phone line. In the event repairs are ever needed on the Synchrony, they should be performed by Respironics or an authorized representative of Respironics. For information contact Respironics. (See page 2-9.)

1.7 Industry Canada Notice

NOTICE: The Industry Canada Label identifies certified equipment. This certification means that the equipment meets telecommunications network protective, operational, and safety requirements as prescribed in the appropriate Terminal Equipment Technical Requirements documents. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should make sure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be coordinated by a representative designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. The precaution may be particularly important in rural areas.

CAUTION: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

Ringer Equivalence Number (REN): The REN assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the Ringer Equivalence Numbers of all the devices does not exceed 5.

Chapter 2: Introduction

2.1 Synchrony Overview

WARNING: The Synchrony can operate on AC or DC power. The DC power option is not intended as a battery backup during use of AC power.

CAUTION: When DC power is obtained from a vehicle battery, the Synchrony should not be used while the engine of the vehicle is running. Damage to the vehicle may occur.

NOTE: The Synchrony is available in two models. The BiPAP Synchrony Lab System is for use by clinicians in a sleep lab setting. The BiPAP Synchrony Ventilatory Support System is for use in a hospital or home setting. Throughout this manual, references to "Synchrony" will apply to both the Lab System and the Ventilatory Support System unless otherwise noted.

NOTE: Throughout this manual, references to Bi-Flex apply only to the Synchrony Lab System.

Figure 2-1 Synchrony

The Synchrony, shown in Figure 2-1, is a low-pressure, electrically driven ventilator system with electronic pressure control. The Synchrony's pressure controls are adjusted to deliver pressure support for patient ventilatory assistance.

The Synchrony is intended to augment patient breathing by supplying pressurized air through a patient circuit. It senses the patient's breathing effort by monitoring airflow in the patient circuit and adjusts its output to assist in inhalation and exhalation. This assistance is provided by the administration of two levels of positive pressure. During exhalation, pressure is variably positive or near ambient. During inspiration, pressure is variably positive and always higher than the expiratory level.

The Synchrony responds reliably to patient flow rates that indicate movement to inhalation or exhalation, even in the presence of most normal leaks in the patient circuit. Automatic adjustment of this trigger threshold in the presence of leaks makes the system ideal for mask-applied ventilation assistance. The patient-controllable Rise Time may enhance patient-ventilator synchrony and patient comfort.

If the patient interface is disconnected, the Synchrony automatically reduces the output flow to a low level. When the interface is replaced, therapy will typically resume when the patient starts to breathe. If therapy does not resume when the patient starts to breathe, the patient should press the RAMP/ALARM SILENCE button to resume therapy.

A modem allows the patient to provide compliance data to the home care provider with a few simple key presses. A communications port provides communication to the Respironics Encore® or Encore Pro Data Management Software.

The Synchrony operates in the following modes:

- Continuous Positive Airway Pressure (CPAP)
- Spontaneous (S)
- Spontaneous/Timed (S/T)
- Timed (T)
- Pressure Control (PC).

2.2 Modes of Operation

2.2.1 CPAP Mode

In the Continuous Positive Airway Pressure (CPAP) mode, the Synchrony delivers a continuous pressure support ventilation at one pressure level.

2.2.2 S Mode

The Spontaneous (S) mode of the Synchrony delivers bi-level pressure support. The unit triggers to Inspiratory Positive Airway Pressure (IPAP) in response to spontaneous inspiratory effort and cycles to Expiratory Positive Airway Pressure (EPAP) during exhalation. Figure 2-2 illustrates the trigger and cycle concepts.

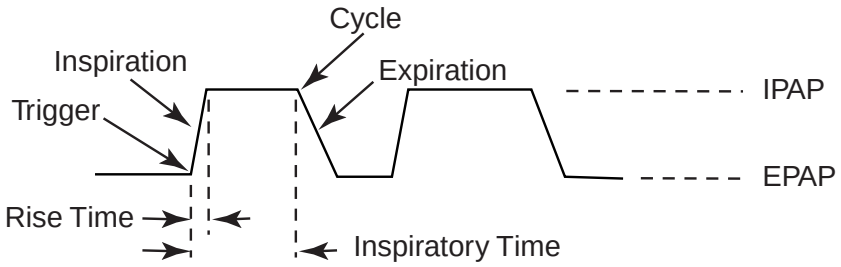


Figure 2-2 Triggering and Cycling in S Mode

The level of pressure support (PS) delivered is determined by the difference between the IPAP and EPAP settings (PS = IPAP - EPAP).

Bi-Flex

The Synchrony Lab System provides the Bi-Flex feature in S mode. The Bi-Flex attribute adjusts therapy by inserting a small amount of pressure relief during the latter stages of inspiration and during active exhalation (the beginning part of exhalation). In the following diagram, the bold lines represent Bi-Flex in comparison to the dashed line representing normal BiPAP therapy. Bi-Flex levels of 1, 2, or 3 progressively reflect increased pressure relief that will take place at the end of inspiration and at the beginning of expiration.

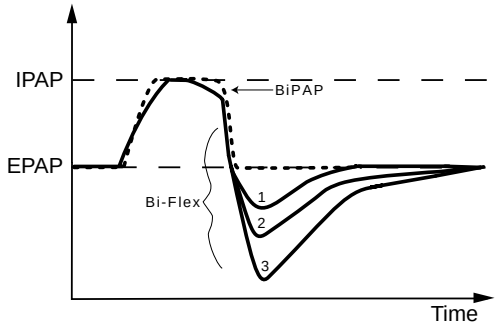


Figure 2-3 Bi-Flex in Comparison to Traditional Bi-level Therapy

2.2.3 S/T MODE

The Spontaneous/Timed (S/T) mode of the Synchrony is similar to the S mode, except that it also can deliver a machine-triggered breath if the patient does not spontaneously breath within a set time.

The S/T mode ensures that patients will receive a minimum number of breaths per minute based on the Rate setting. If the patient fails to initiate an inspiration within the interval determined by the Rate control, the unit triggers a timed (or machine-triggered) breath resulting in a pressure-control (pressure-limited, time-cycled) breath at the set IPAP level. The rate of timed breaths is adjustable. The duration of each timed breath is controlled by an Inspiratory Time control. See Figure 2-4 for an example of patient-triggered and machine-triggered breaths.

Example:

IPAP = 14 cm H_2O
EPAP = 6 cm H_2O
Rate = 10 BPM
PS = 8 cm H_2O

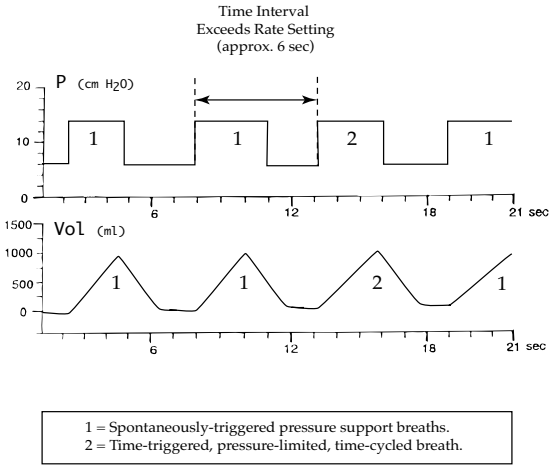


Figure 2-4 Example of Patient-Triggered and Machine-Triggered Breaths

2.2.4 PRESSURE CONTROL MODE

The Pressure Control (PC) mode is similar to the S/T mode, except that all breaths are machine-cycled. The PC mode is a pressure-limited, machine- or patient-triggered, time-cycled mode. Therefore, the inspiratory pressure may be triggered by the patient or by the Synchrony, but IPAP will be pressure-limited with a set cycle time determined by the Inspiratory Time control.

2.2.5 TIMED MODE

The Timed (T) mode provides mandatory pressure assist with bi-level pressures. All breaths are machine-triggered and machine-cycled; the patient's breathing rate has no effect on the machine rate or pressure levels. The trigger to IPAP is determined by the Rate control, and the cycle time is determined by the Inspiratory Time control.

2.2.6 Mode Summary

Table 2-1 summarizes the initiation of triggers and cycles for each bi-level mode.

Mode	Trigger	Limit	Cycle
S	Patient	Pressure	Patient or Device
S/T	Patient or Machine	Pressure	Patient or Device
PC	Patient or Machine	Pressure	Device
T	Machine	Pressure	Device

Table 2-1 Initiation of Triggers and Cycles for Synchrony Modes

2.3 Digital Auto-Trak Sensitivity™

An important characteristic of the Synchrony is its ability to recognize and compensate for unintentional leaks in the system and to automatically adjust its trigger and cycle algorithms to maintain optimum performance in the presence of leaks. This feature is known as Digital Auto-Trak Sensitivity. The following sections examine this function in detail by describing the leak tolerance function and sensitivity.

2.3.1 Leak Tolerance

A microprocessor monitors the total flow of the patient circuit and calculates patient flow values.

1. Leak Estimation—Average and Parabolic

The Synchrony uses two leak estimation algorithms. A conservation of mass algorithm is used to compute the average leak for a given pressure support relationship. This average leak is used when large leak variations are present in the system. Average leak is a high estimate during EPAP pressure and a low estimate during IPAP pressure.

A better leak estimate, enabled by the digital system, is the parabolic leak algorithm. Parabolic leak is proportional to the square of the patient pressure; therefore, the leak estimate is correlated to the changing patient pressure. Both algorithms include unintentional circuit leak and are averaged over several breaths.

2. Patient Flow

The total circuit flow is comprised of the circuit leak and the patient flow. The calculated patient flow is the total flow minus the circuit leak. Patient flow is a primary input into the triggering and cycling mechanisms.

2.3.2 Sensitivity

An essential feature of the Synchrony while operating in the S, S/T, and PC modes is its ability to effectively sense spontaneous breathing efforts, which causes the ventilator to trigger to IPAP and cycle to EPAP. Because no preset sensitivity threshold can assure patient and machine synchrony with changing breathing efforts and circuit leaks, the Synchrony continuously tracks patient breathing patterns and automatically adjusts sensitivity thresholds to ensure optimum sensitivity as breathing patterns change or as circuit leaks change. The algorithms used to ensure optimum sensitivity are the Volume Trigger, Shape Signal, and the Spontaneous Expiratory Threshold (SET).

Volume Trigger (EPAP to IPAP)

The volume trigger is one method used to trigger IPAP during spontaneous breathing in the S, S/T, and PC modes. The volume trigger threshold is 6 cc of accumulated patient inspiratory volume. When patient effort generates inspiratory flow causing 6 cc of volume, IPAP is triggered.

Shape Trigger/Shape Cycle (EPAP to IPAP) (IPAP to EPAP)

The shape trigger/cycle is another method used to trigger IPAP and/or cycle from IPAP to EPAP during spontaneous breathing in the S, S/T, and PC modes. This method continuously tracks patient inspiratory and expiratory flow and adjusts the spontaneous trigger and cycle thresholds for optimum sensitivity. The Shape Signal appears as a shadow image of the patient's actual flow. The shape signal functions as a sensitivity threshold at either inspiration or expiration. When the patient's flow rate crosses the shape signal the unit changes pressure levels. Figure 2-5 illustrates how the shape signal is superimposed onto the actual waveform to trigger and cycle off IPAP.

The shape signal is created by offsetting the signal from the actual patient flow by 15 L/min and delaying it for a 300 msec period. This intentional delay causes the shape signal to be slightly behind the patient's flow rate. A sudden change in patient flow will cross the shape signal, causing the pressure level to change.

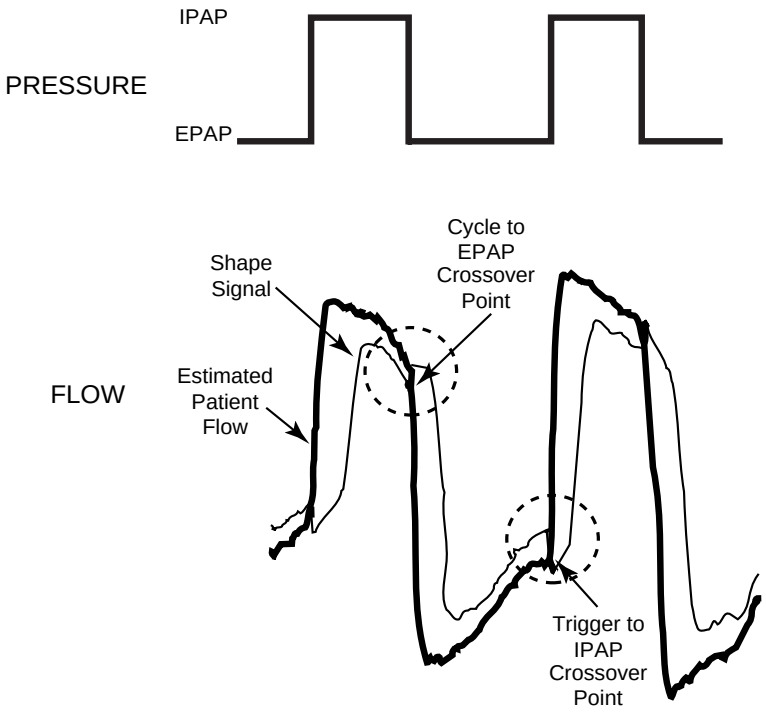


Figure 2-5 Shape Signal

Tracking the patient's flow pattern with the Shape Signal provides a sensitive mechanism to trigger to IPAP or cycle to EPAP in response to changing breathing patterns and circuit leaks.

Spontaneous Expiratory Threshold (IPAP to EPAP)

A second method used to cycle off IPAP during spontaneous breathing in the S, S/T, and PC modes is called Spontaneous Expiratory Threshold (SET). The SET rises in proportion to the inspiratory flow rate on each breath. When the Spontaneous Expiratory Threshold (SET) and actual patient flow value are equal, the unit cycles to EPAP.

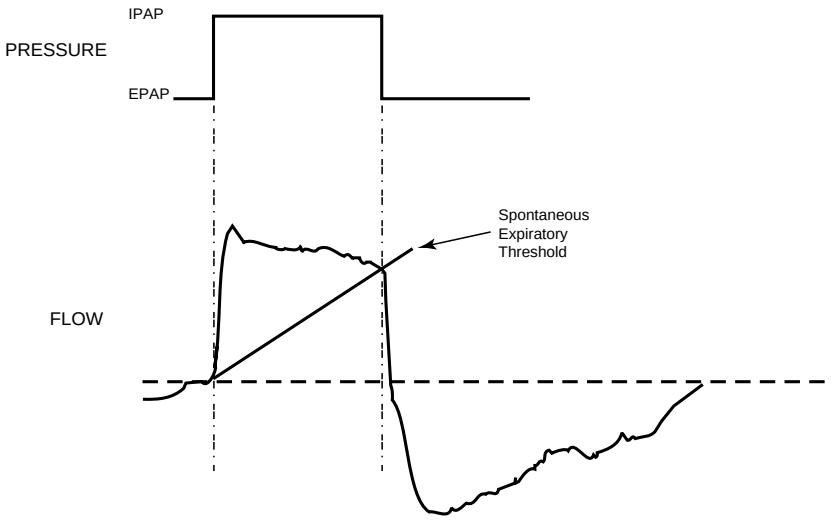


Figure 2-5 Spontaneous Expiratory Threshold

Maximum IPAP Time (IPAP to EPAP)

A maximum IPAP time of 3.0 seconds acts as a safety mechanism to limit the time spent at the IPAP level during spontaneous breathing in the S, S/T, and PC modes. Once the time limit is reached, the unit automatically cycles off IPAP to the EPAP level.

Flow Reversal (IPAP to EPAP)

As flow begins to decrease during IPAP, a flow reversal can occur due to a large leak around the mask or because the patient's mouth is open. When the Synchrony unit senses this flow reversal, the unit automatically cycles to the EPAP level.

Summary

The sensitivity criteria for spontaneous breathing in the S, S/T, and PC modes can be summarized as follows:

Spontaneous Trigger to IPAP

A transition from EPAP to IPAP will occur when one of the following conditions is met:
- Patient flow exceeds the shape signal
- 6 cc inspired patient volume

Cycle to EPAP

The transition from IPAP to EPAP will occur when one of the following conditions is met:
- Patient flow is less than the shape signal
- Spontaneous Expiratory Threshold (SET) is achieved
- A 3.0 second maximum IPAP time has occurred (safety feature)
- Flow reversal occurs during IPAP (safety feature)

2.4 Access Levels

The Synchrony can be set to a Lockout mode so that certain settings and displays cannot be accessed. In the Lockout mode, the IPAP Rise Time can be adjusted if Bi-Flex is not enabled. If Bi-Flex is enabled, then it is adjustable in Lockout Mode. Rise Time cannot be adjusted in Lockout mode when Bi-Flex is enabled. Only the IPAP, EPAP, and Respiratory Rate are displayed in Lockout Mode.

In the Full Access level, all ventilator functions and displays are accessible.

Section 7.2.6 describes the procedure to set the access level.

2.5 Symbol Key

The following symbols are used on the Synchrony:

Symbol	Meaning
	AC Power Indicator
	DC Power Indicator
	Alarm Indicator
	Type BF Applied Part
	Class II for Protection Against Electric Shock
	Attention, consult accompanying documents
	Standby Key (Start/Stop)
	Up Key
	Down Key
	Enter Key
	Ramp Start/Alarm Silence Key

2.6 Definitions, Acronyms, and Abbreviations

The following terms are used in this manual:

Bi-Flex—A therapy feature that establishes a level of pressure relief taking place at the end of inhalation and at the start of exhalation.

BiPAP—Bi-level Positive Airway Pressure

CPAP—Continuous Positive Airway Pressure

Cycle—The transition from inspiration to expiration

EPAP—Expiratory Positive Airway Pressure

High Priority Alarm—Alarm signal indicating a condition that requires immediate attention

IPAP—Inspiratory Positive Airway Pressure

Low Priority Alarm—Signal indicating an information message

Medium Priority Alarm—Alarm signal indicating a condition that requires operator awareness

OSA—Obstructive Sleep Apnea

Ramp—A feature that may increase patient comfort when therapy is started. The Synchrony IPAP starts at the EPAP level and is increased gradually (breath by breath over several breaths) until the IPAP prescription pressure is reached.

RR—Respiratory Rate

Trigger—The transition from expiration to inspiration

2.7 Service

If you need product support, call Respironics' Customer Service Department: 1-800-345-6443 (USA or Canada only) or 1-724-387-4000.

Chapter 3: Controls and Displays

This chapter describes the control panel and displays, the patient circuit connections, and the rear panel connections.

3.1 Control Panel

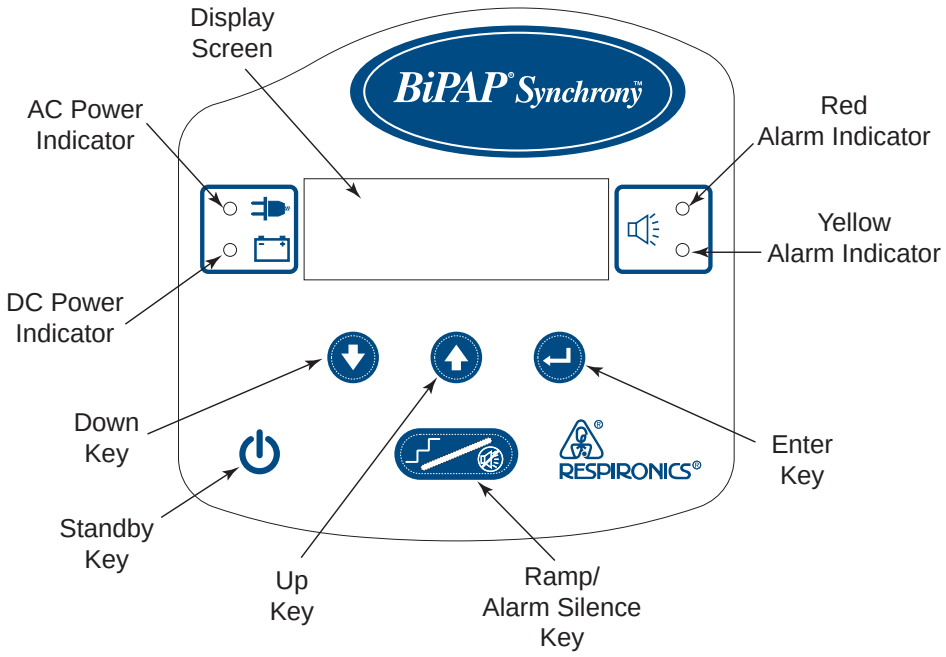


Figure 3-1 The Synchrony Control Panel

Figure 3-1 illustrates the Synchrony control panel. The control panel includes:

- display screen
- control keys
- alarm indicators
- power indicators.

3.1.1 Display Screen

The display screen is used to display operating parameters, instructions, and messages. A backlight is activated when the ▲, ▼, or ↵ key is pressed, and remains on until there are no keystrokes for one minute. If the backlight is off, the first press of any of these keys will only turn the backlight on; the normal key action is suppressed until the key is pressed a second time.

3.1.2 CONTROL KEYS

The Synchrony control panel has five membrane-type switches that perform different functions depending on the screen selected, alarm status, and access level:

Standby Key Starts and stops the Synchrony. The key must be pressed and released.

Up Key Navigates between screens or increases the value of a selected parameter by one increment.

Down Key Navigates between screens or decreases the value of a selected parameter by one increment.

Enter Key Switches the function of the Up and Down keys between screen navigation and parameter adjustment, and implements changes.

Ramp/Silence Key Activates ventilation ramp and silences the audible alarm signal.

3.1.3 INDICATORS

The Synchrony uses four LED indicators on the control panel for alarm indications and power indications. It also uses five indicators on the display screen.

AC Power Indicator

Green LED that illuminates when the Synchrony is connected to AC power. See Figure 3-2.

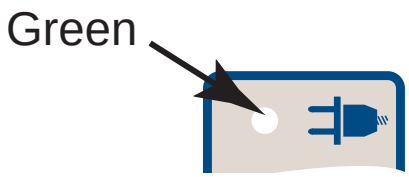


Figure 3-2 AC Power Indicator

DC Power Indicator

Green LED that illuminates when the Synchrony is connected to DC power. See Figure 3-3.

Figure 3-3 DC Power Indicator

Red Alarm Indicator

- When flashing indicates a new high priority alarm has occurred.
- When on continuously indicates a loss of power or silenced high priority alarm.

Yellow Alarm Indicator

- When flashing indicates a new medium priority alarm.
- When on continuously indicates a low priority alarm or silenced medium priority alarm.

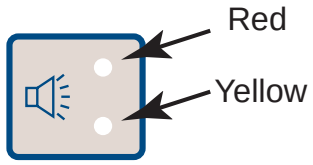


Figure 3-4 Alarm Indicators

Attention or Activity Indicator (●)

Used in several screens to indicate pressure level, machine-triggered breaths, or alarm messages:

- When ● appears next to EPAP or IPAP on the display, it indicates the current pressure phase. See Figure 3-5.
- When ● appears next to an alarm message, it indicates that the alarm is active. See Figure 3-6.
- When ● appears next to RR on the display, it indicates that the current pressure phase was device-triggered. See Figure 3-7.

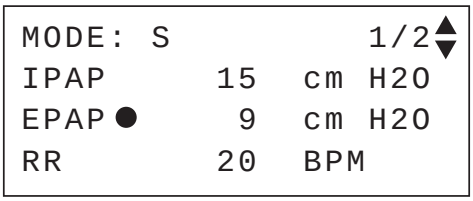


Figure 3-5 EPAP Indicator

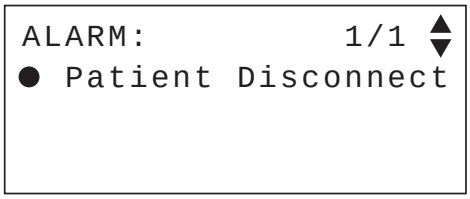


Figure 3-6 Alarm Indicator

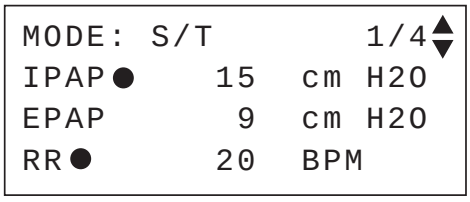


Figure 3-7 Device-Triggered Breath Indicator

Selection Indicator (►)

► appears next to the item that can be selected with the ENTER key, as shown in Figure 3-8. The indicator is moved by pressing the UP or DOWN key.

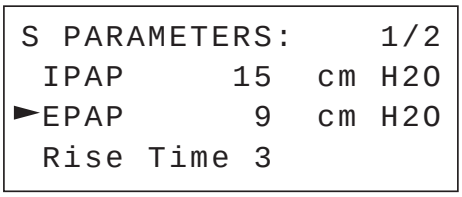


Figure 3-8 Selection Indicator; Pressing the ENTER Key will Select EPAP for Adjustment

Navigation Indicator (▲▼)

▲▼ appears next to a page number display to indicate that the UP and DOWN keys can be used to change pages, as shown in Figure 3-9. If it appears next to a value, it flashes and indicates that the UP and DOWN keys can be used to adjust the value, as shown in Figure 3-10.

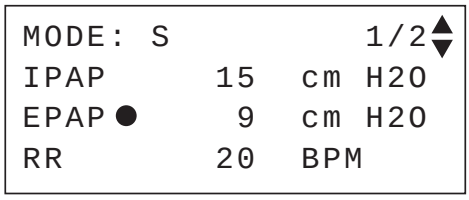


Figure 3-9 Page Indicator

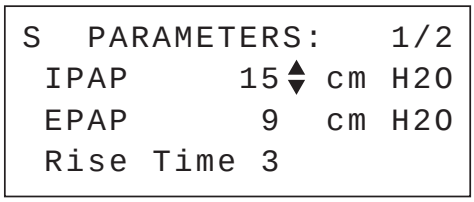


Figure 3-10 Value Adjust Indicator; IPAP can be adjusted with the UP or DOWN key

Ventilation Ramp Indicator (⌐)

⌐ appears at the top of the display when ventilation ramp has been initiated. See Figure 3-11.

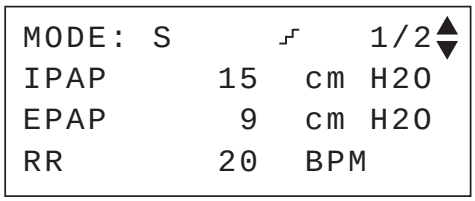


Figure 3-11 Ventilation Ramp Indicator

Progress Indicator (▬)

The ▬ consists of seven segments that empty from top to bottom to indicate the progress of certain operations. See Figure 3-12. The four indicators work simultaneously.

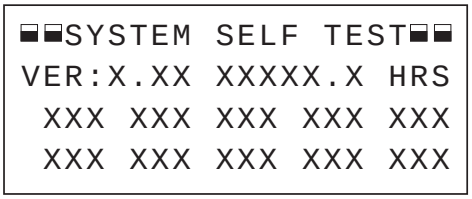


Figure 3-12 Progress Indicators

Alarm Enabled Indicator (A)

The A appears in the Monitoring screen if any of the patient alarms (Patient Disconnect, Apnea, or Low Minute Ventilation) is enabled (see Chapter 8).

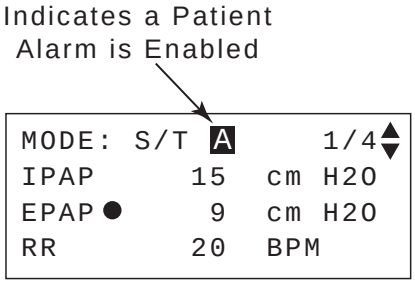


Figure 3-13 Monitoring Screen with Alarm Enabled Indicator

3.2 Navigating the Screens

When the screen indicates that there are multiple pages (1/3, 2/4, etc. appear in the upper right corner), you can scroll through the pages by pressing either the DOWN arrow key when the last item on the screen is selected, or by pressing the UP arrow key when the first item is selected.

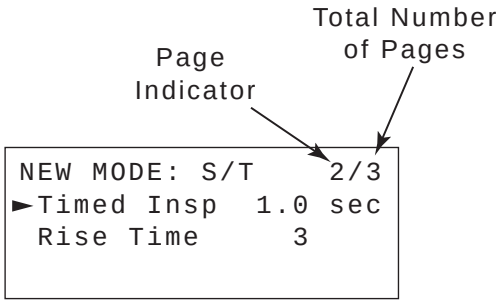


Figure 3-14 Example of Page Indicator on Screen

In the example of Figure 3-14, if you press the UP key, the Synchrony displays page 1 of 3; if you press the DOWN key twice, the Synchrony displays page 3 of 3.

3.3 Display Data

The display screen is used to display measured parameters in the Monitoring screens. The data changes depending on the access level and the mode of operation.

The Synchrony is capable of displaying:

- **CPAP, IPAP, and EPAP** - These displays are estimates of measurements at the patient connection. Displays are updated as follows: CPAP is updated at the end of inspiration; IPAP is updated at the end of IPAP; and EPAP is updated at the end of EPAP.
- **RR** (Respiratory Rate) - The breathing rate is a running average from the six previous breaths. If the Synchrony is operating in a mode that supports machine-triggered breaths, this display will be the total breathing rate (spontaneous + machine). The display value is updated at the end of each expiration.
- **V_{TE}** (Estimated Exhaled Tidal Volume) - Displays an estimated exhaled tidal volume measurement for the previous breath. The display is updated at the end of each breath. The estimated exhaled tidal volume is obtained by integration of patient flow.
- **MinVent** (Estimated Exhaled Minute Ventilation) - Displays the estimated exhaled minute ventilation based on an average of the previous six breaths. The display is updated at the end of each breath.
- **Leak** - Displays the average leak value calculated during the previous breath cycle. The display value is updated after each breath.

NOTE: The Estimated Exhaled Tidal Volume and the Estimated Exhaled Minute Ventilation displays represent estimates. There are some circumstances, such as low tidal volumes, erratic breathing, or rapidly changing leak where the accuracy of the estimates will vary greatly. The Estimated Exhaled Tidal Volume and the Estimated Exhaled Minute Ventilation displays will flash during some transient conditions.

Table 3-1 summarizes the displayed parameters.

Parameter	Units	Access Level	Mode
CPAP	cm H_2O	BOTH	CPAP
IPAP	cm H_2O	BOTH	S, T, PC, S/T
EPAP	cm H_2O	BOTH	S, T, PC, S/T
RR	BPM	BOTH	ALL
V_{T_E}	ml	FULL	ALL
MinVent	L/min	FULL	ALL
Leak	L/min	FULL	ALL

Table 3-1 Displayed Parameters

Different display screens are available based on the access level:

Full Access—

Screen 1/4 Monitoring Screen Page 1
Screen 2/4 Monitoring Screen Page 2
Screen 3/4 Patient Controls
Screen 4/4 Caregiver Menu

Lockout—

Screen 1/2 Monitoring Screen Page 1
Screen 2/2 Patient Controls

See Section 4.4 for illustrations of these screens.

3.4 Patient Circuit Connection

The patient circuit is connected to the patient interface port shown in Figure 3-15. The patient interface port accepts a bacteria filter or a tubing connector for reusable or disposable tubing.

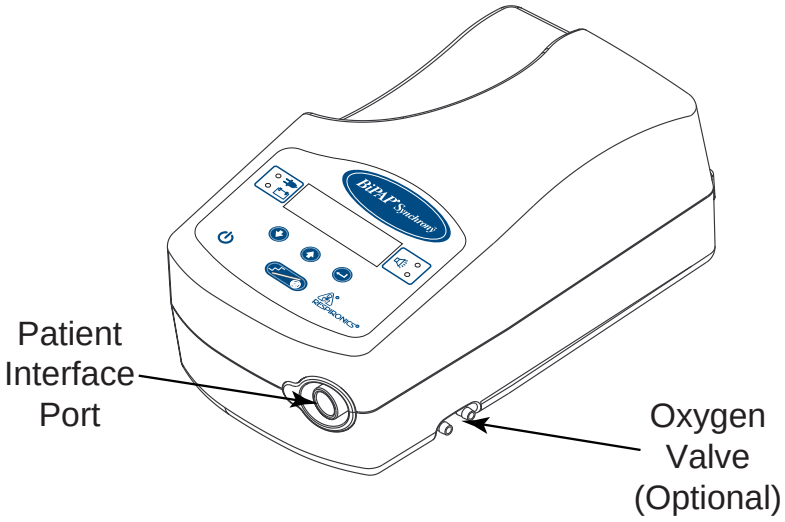


Figure 3-15 Synchrony Patient Interface Port and Optional Oxygen Valve

3.5 Optional Oxygen Valve

The Synchrony optional oxygen valve is mounted under one side of the Synchrony, as shown in Figure 3-15. The valve must be used if oxygen is to be titrated into the breathing circuit. See Chapter 10 for instructions.

3.6 Rear Panel

Figure 3-16 shows the rear panel of the Synchrony.

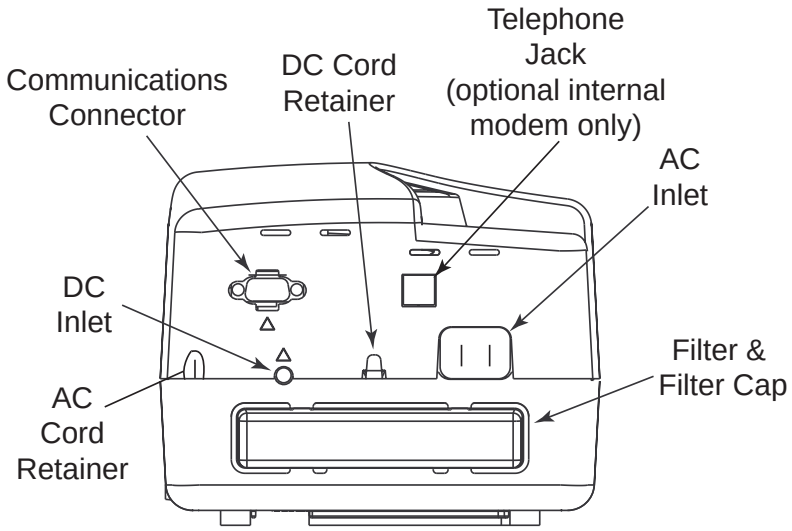


Figure 3-16 The Synchrony Rear Panel

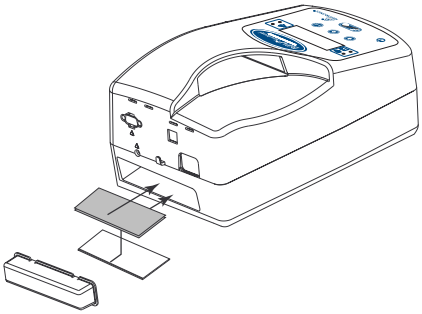
The rear panel contains

- the AC inlet that accepts the AC power cord
- the DC inlet that accepts the DC power cord
- the filter cap that is removed to inspect the inlet air filters (see Chapter 11)
- the RS-232 communications connector that accepts the Respironics Communications Cable for computer and external modem communication
- the RJ-11 telephone jack, provided with Synchrony devices having an optional internal modem, for remote data readings
- the DC power cord retainer that provides strain relief for the DC power cord
- the AC cord retainer that provides strain relief for the AC power cord.

Chapter 4: Setting up and Starting the Synchrony

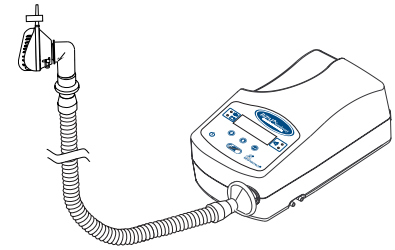
4.1 Preparing the Synchrony

4.1.1 Summary of Setup Operations



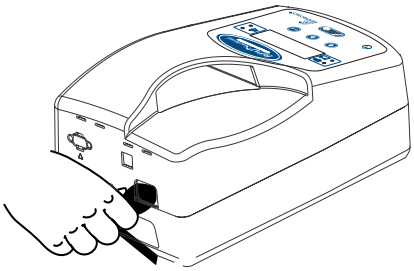
Step 1 Install the inlet air filters.

See Section 4.1.2.



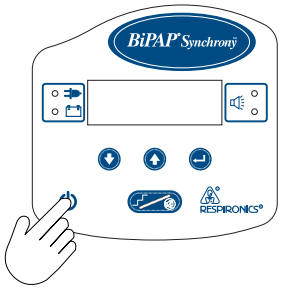
Step 2 Assemble and attach the patient circuit.

See Section 4.1.3



Step 3 Provide power and set up the patient.

See Sections 4.1.4 to 4.1.6.



Step 4 Set up the patient parameters using the control panel.

See Section 4.2.

4.1.2 Installing the Air Filters

The Synchrony uses one or two removable filters at the air inlet. You must install the gray foam filter before operating the Synchrony. The gray foam filter is washable and reusable. The disposable white ultra-fine filter is optional.

CAUTION: A properly installed, undamaged gray foam inlet filter is required for proper operation.

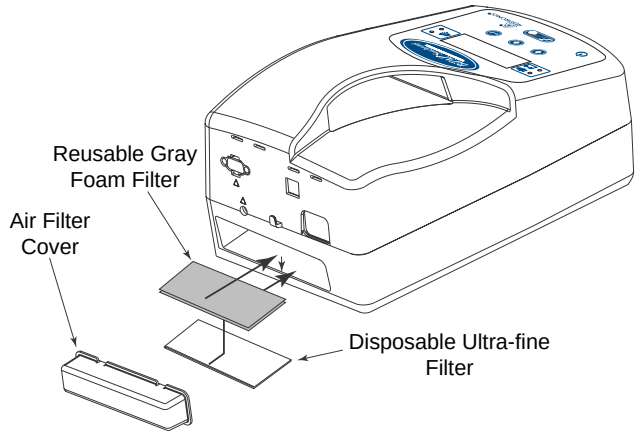


Figure 4-1 Installing the Air Filters

Step 1 Place the gray foam filter on top of the ultra-fine filter (if using the ultra-fine filter).

Step 2 Slide the filters into the air inlet at the rear of the Synchrony and push them down into the recess as shown in Figure 4-1.

Step 3 Place the bottom of the air filter cover into the bottom of the air inlet opening, making sure that the catches engage the lip of the opening.

Step 4 Swing the top of the cover into place and press down on the cover to engage the catches in the air inlet opening. See Figure 4-2.

See Chapter 11 to clean or replace the filters.

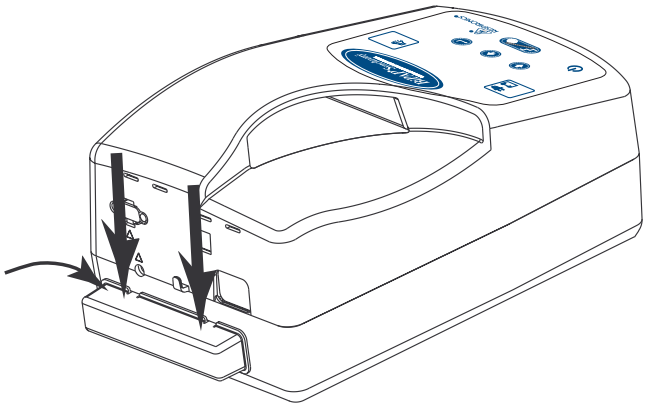


Figure 4-2 Replacing the Air Filter Cover

4.1.3 Assembling the Patient Circuit

WARNING: The exhalation device (e.g., the Whisper Swivel® II) or exhalation port (on masks with integrated exhalation port) is designed to exhaust CO_2 from the patient circuit. Do not block or seal the ports on the exhalation device.

WARNING: The oxygen valve must be installed and used if oxygen is to be titrated to the patient circuit. See Chapter 10 for complete details.

Step 1 Assemble the patient circuit according to the configurations presented in Chapter 12.

Step 2 If required, connect a bacteria filter to the patient interface port (shown in Figure 4-3), and connect the patient tubing to the outlet of the bacteria filter.

- If the bacteria filter is not required, connect the patient tubing directly to the patient interface port.
- If oxygen is to be used, connect it according to Chapter 10.
- If a humidifier is to be used, connect the inlet to the bacteria filter outlet or to the patient interface port.

A completed assembly is shown in Figure 4-3.

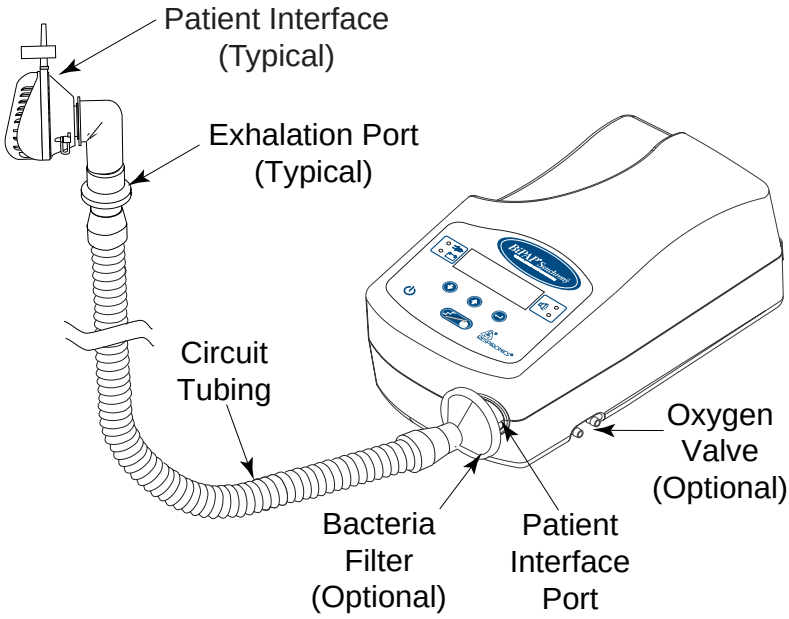


Figure 4-3 An example of a Respironics-approved circuit

4.1.4 SUPPLYING POWER TO THE SYNCHRONY

WARNING: The Synchrony can operate on AC or DC power. The DC power option is not intended as a battery backup during use of AC power.

CAUTION: When DC power is obtained from a vehicle battery, the Synchrony should not be used while the engine of the vehicle is running. Damage to the vehicle may occur.

AC OPERATION

Plug the electrical cord into the AC inlet in the back of the Synchrony, then plug the electrical cord into an outlet that is not controlled by a wall switch.

NOTE: Use the AC cord retainer to provide strain relief for the AC power cord.

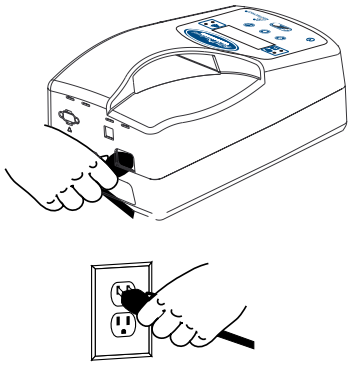


Figure 4-4 Plugging in the AC Cord

DC OPERATION

STEP 1 Plug the DC cord connector into the rear of the Synchrony.

STEP 2 Leaving a small amount of slack in the cord, press the cord into the DC cord retainer.

STEP 3 Connect the DC cord to the appropriate DC source.

Refer to the DC cord instruction sheet for recommended DC power sources.

CAUTION: Only use a Respironics-supplied DC cord.

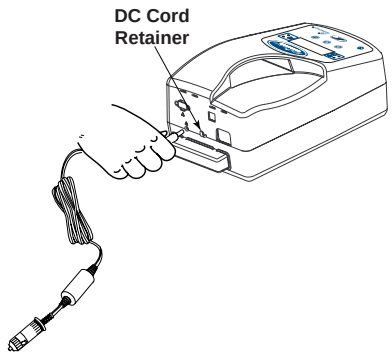


Figure 4-5 Plugging in the DC Cord

4.1.5 Optional Internal Modem

The optional internal modem is set up as shown in Chapter 7.

4.1.6 Performance Verification

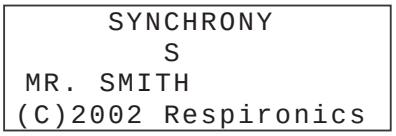
When the initial setup is complete, perform the performance verification as described in Chapter 13.

4.2 Setting Up the Synchrony

Before using the Synchrony on a patient, set the prescription:

1. To change the mode of operation, see Chapter 6.
2. To change the parameters, see Chapter 5.
3. To view or change the options, see Chapter 7.
4. Set the necessary alarms (see Section 8.2).

4.3 Connecting the Patient



NOTE: If your device is a system for home use, "S" or "S/T" will appear on the startup screen--depending on the model.
If your device is a Lab System, "LAB" will appear before "S" or "S/T" on the startup screen.

NOTE: If you have entered a patient ID for the device (see Section 7.2.4), that text will also appear on the startup screen.

Step 1 Press and release the Standby key.

The start-up screen is displayed, then the Synchrony initiates a self-test. Both alarm LED indicators light momentarily, the audible alarm beeps twice to verify that the audible alarm is functioning. The start-up screen is then displayed, followed by the self-test screen. If the indicators do not light, or the audible alarm does not beep twice, the Synchrony requires service.

Step 2 If a Plateau Exhalation Valve (PEV) is used, enable the PEV option (see Section 7.2.5).

Step 3 If oxygen is being used, turn on the oxygen flow. Always turn the Synchrony on before turning on the oxygen, and always turn the oxygen off before turning off the Synchrony.

Step 4 Place the mask on the patient.

Step 5 When the setup is complete place the Synchrony in Lockout (see Section 7.2.6).

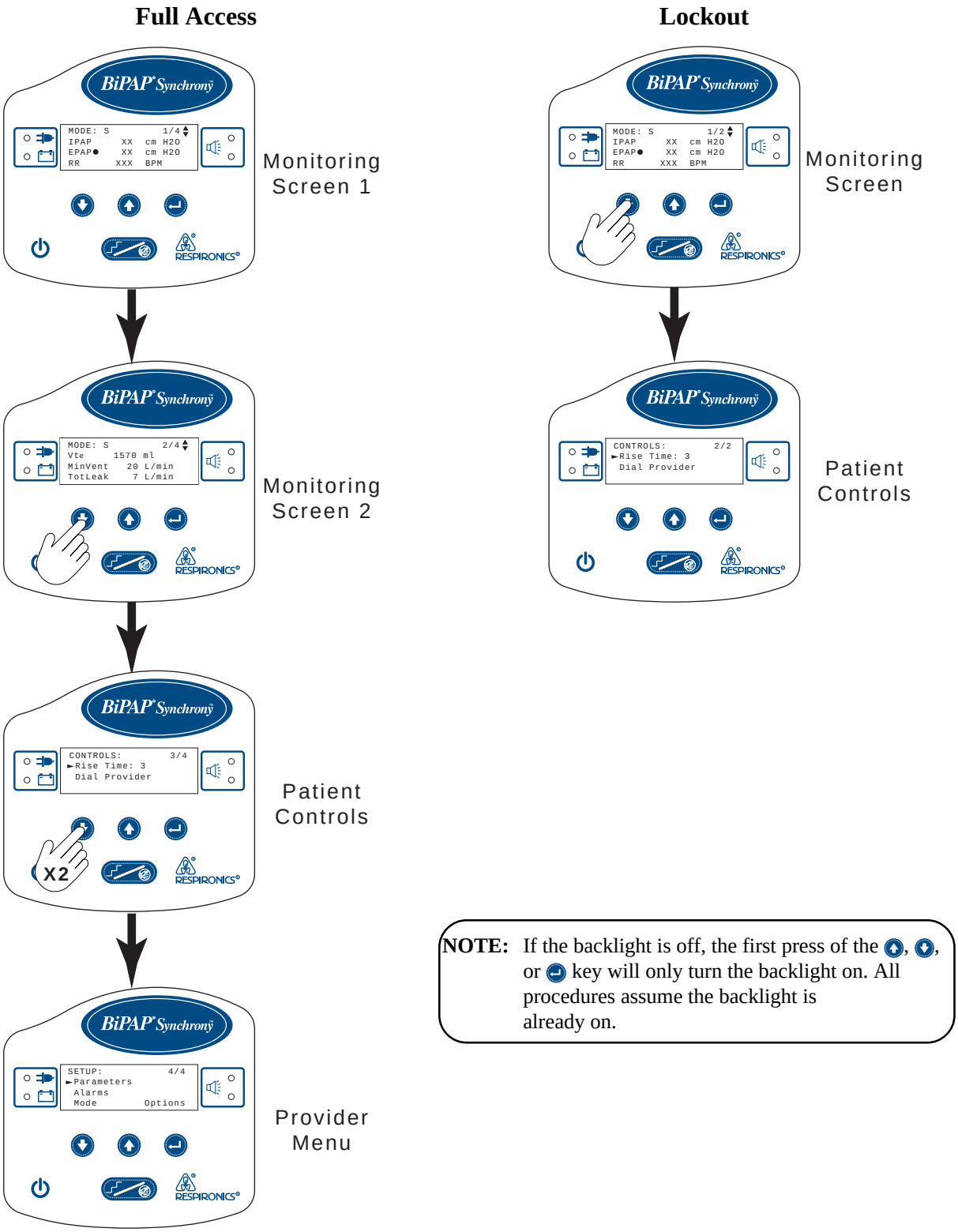
See Chapter 8 for alarm information.

See Chapter 10 if you are administering oxygen to the patient.

NOTE: Before placing the patient on the Synchrony, check the integrity of the patient circuit, the exhalation port, and the alarms.

4.4 Operating the System

During operation, the screen shows Monitoring Screen 1 (see Section 3.3). To change patient controls, go to the Patient Controls screen. To change parameters, go to the Caregiver Menu screen. The display returns to Monitoring Screen 1 if no keys are pressed for one minute.



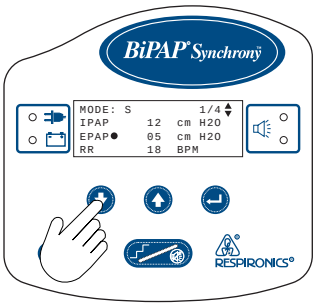
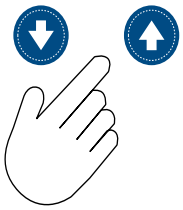
NOTE: If the backlight is off, the first press of the ▲, ▼, or ↵ key will only turn the backlight on. All procedures assume the backlight is already on.

4.5 Patient Operating Instructions

With the Synchrony in Lockout, the patient is restricted to viewing only the pressure levels and the respiratory rate. The patient may change the Rise Time, dial the provider with the modem, and initiate the ventilation ramp.

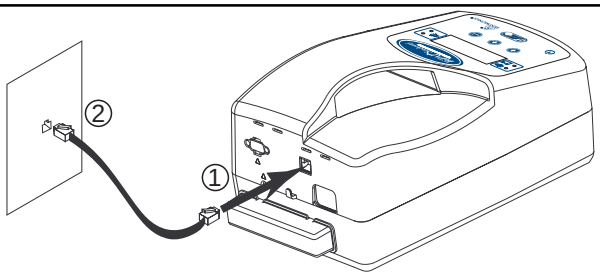
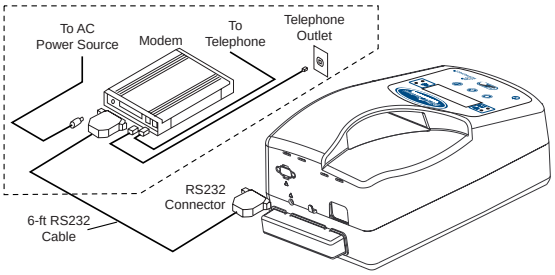
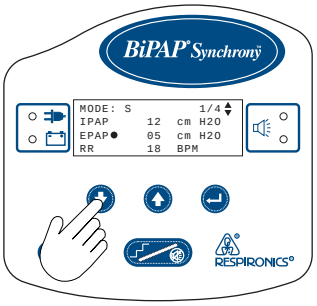
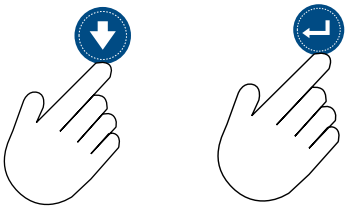
4.5.1 Setting the Rise Time

The Rise Time parameter is adjustable so that the patient can find the most comfortable setting. To change the Rise Time:

PATIENT ACTION	RESULT
Step 1 From the Monitoring Screen, press the DOWN key to display the Patient Controls 	**NOTE:** If the backlight is off, the first press of the ▲, ▼, or ↵ key will only turn the backlight on. All procedures assume the backlight is already on. CONTROLS: 3/4 ►Rise Time: 3 Dial Provider
Step 2 Press the ENTER key to activate the Rise Time control.	CONTROLS: 3/4 Rise Time: 3▲▼ Dial Provider
Step 3 Press the DOWN or UP key to adjust the Rise Time. 	CONTROLS: 3/4 Rise Time: 3▲▼ Dial Provider
Step 4 Allow the machine to cycle several times to see if it feels better. Press ENTER to return to the control selection screen.	CONTROLS: 3/4 ►Rise Time: 4 Dial Provider

4.5.2 DIALING THE PROVIDER

When instructed to do so, the patient can upload data from the Synchrony with the modem. The instructions to program the modem are in Section 7.2.4. The Synchrony can be in use by the patient while downloading data.

PATIENT ACTION	RESULT
STEP 1 If you are using an external modem, attach the RS 232 cable from the Synchrony to the modem. If you are connecting an external modem through a telephone line, plug a telephone line from the rear of the Synchrony to a convenient telephone outlet. NOTE: Items within the dashed line must be at least six feet away from the patient. NOTE: See Appendix A for external modem requirements.	 ***Internal Modem Connection***  ***External Modem Connection***
STEP 2 From the Monitoring Screen, press the DOWN key to display the Patient Controls  	CONTROLS: 3/4 ►Rise Time: 3 Dial Provider
STEP 3 Press the DOWN key to select the Dial Provider command, then press ENTER to dial the caregiver and send the report. 	SENDING REPORT STATUS: Dialing ► ABORT The STATUS changes from “Dialing” to “Connected” to “Complete” under normal circumstances. If you press ENTER when ABORT is displayed in the Call screen, the call will stop and the screen will go to STATUS: Complete.

NOTE: The word “Provider” on the Synchrony display screen can be replaced by an alphanumeric string you enter. See the Section 7.2.4 for details.

To send a report before therapy is started:

PATIENT ACTION		RESULT
STEP 1	With the Synchrony not running, press the STANDBY key.	The start-up screen is displayed, followed by the self-test screen.
STEP 2	When the self-test screen appears, press the UP key.	The Dial Provider screen is displayed.
STEP 3	Press the UP or DOWN key to select the Dial Provider Command, then press ENTER.	The STATUS changes from “Dialing” to “Connected” to “Complete” under normal circumstances. If you press ENTER when ABORT is displayed in the Call screen, the call will stop and the screen will go to STATUS: Complete.

4.5.3 DATA TRANSMISSION ERRORS

STATUS Message	Possible Cause	What to Do
No Modem	Modem is not installed properly or not connected correctly.	Call your home care provider.
No Dial Tone	A phone is off the hook or telephone line is not working.	Press ↵ to exit, check the telephone line connection. Lift the receiver of your telephone to make sure that you have a dial tone.
Line Busy	The provider’s line is in use.	The Synchrony will try to make the connection again after a slight delay. Press ↵ if you wish to stop the redialing. You should set the modem to try several times before stopping.
Send Failed	1. If occurs shortly after first try, the Synchrony does not have a phone number entered into it. 2. If occurs after many “Line Busy” and “Retry” messages, the Synchrony tried too many times, with the line busy.	1. Press ↵ to exit. Provide a phone number. 2. Press ↵ to exit; try again later.

4.5.4 USING THE RAMP FUNCTION

The Synchrony is equipped with a ramp function that starts the IPAP pressure at the EPAP level. The IPAP pressure is increased at each breath until the full prescription level is reached. You set the increment per breath and enable or disable the ramp as shown in Section 5.2.

Figure 4-6 illustrates the ramp function.

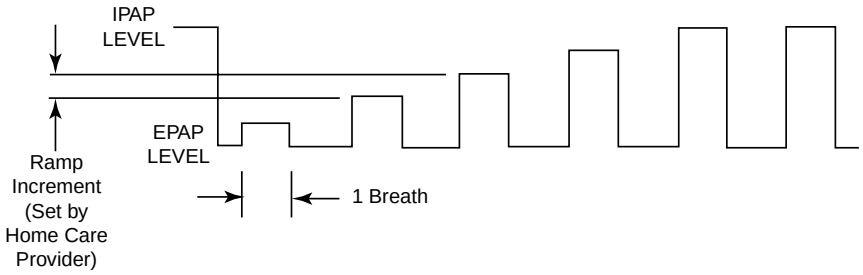


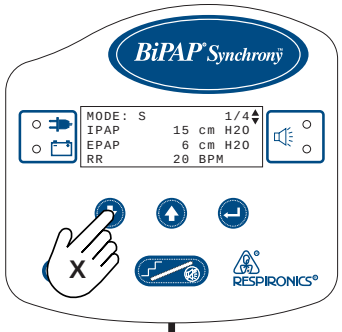
Figure 4-6 The Synchrony Ramp Function

To start the Ramp feature, press . The Ramp indicator will be shown at the top of the display.

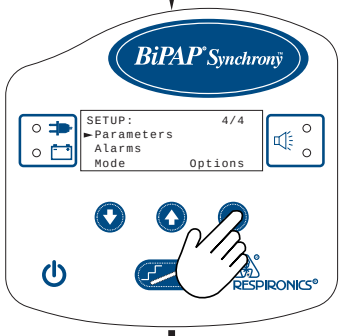
Chapter 5: Changing Parameters

5.1 Summary of Change Parameters Operations

Full Access Only



NOTE: The "X" shown in the hand means that multiple presses are required to attain the next screen shown.



S Mode

```
S   PARAMETERS:  1/2
►IPAP  19  19 cm H2O
 EPAP   5   5 cm H2O
 Rise Time 3
```

```
S   PARAMETERS:  2/2
►VentRamp OFF
 Bi-Flex  OFF
              EXIT
```

CPAP Mode

```
CPAP PARAMETERS:
►CPAP  10  10 cm H2O
 VentRamp OFF
              EXIT
```

T, PC, S/T Modes

```
XX  PARAMETERS:  1/3
►IPAP  19  19 cm H2O
 EPAP   5   5 cm H2O
 Rate  20  20 BPM
```

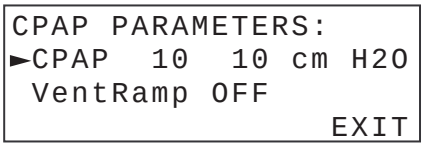
```
XX  PARAMETERS:  2/3
►Timed Insp  1.0 sec
 Rise Time     3
```

```
XX  PARAMETERS:  3/3
►VentRamp OFF

              EXIT
```

NOTE: If the backlight is off, the first press of the ▲, ▼, or ↵ key will only turn the backlight on; the normal key action is suppressed until the key is pressed a second time. All procedures assume the backlight is already on.

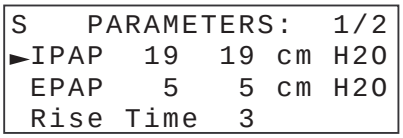
5.2 Change Parameters Screens

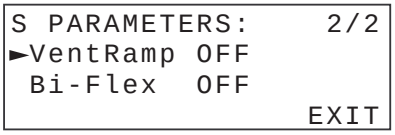
5.2.1 CPAP Mode



Parameter	Range	Increment of Change
CPAP	4 to 20 cm H_2O	1 cm H_2O
Ventilation Ramp	Disabled, 0.5, 1.0, 2.0, 3.0 cm H_2O per breath	Discrete values as listed

5.2.2 S Mode





Screen Number	Parameter	Range	Increment of Change
Screen 1 of 2	IPAP	4 to 30 cm H_2O	1 cm H_2O
	EPAP	4 to 25 cm H_2O	1 cm H_2O
	Rise Time	1 to 6	1
Screen 2 of 2	Ramp	Disabled, 0.5, 1.0, 2.0, 3.0 cm H_2O per breath	Discrete values as listed
	Bi-Flex	OFF, 1, 2, 3	Discrete values as listed

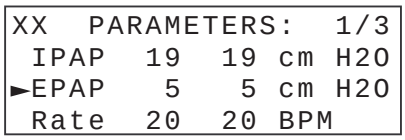
NOTE: IPAP cannot be set lower than EPAP.

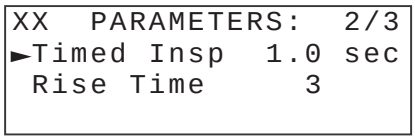
When Bi-Flex is enabled, Rise Time is set to 3 (0.3 seconds).

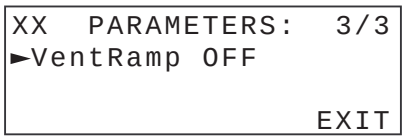
When Bi-Flex is enabled, then IPAP and EPAP are limited to 20 cm.

The Rise Time of 1 to 6 corresponds to tenths of a second (e.g., a setting of 4 equals 0.4 second rise time).

5.2.3 T, PC, AND S/T MODES







Screen Number	Parameter	Range	Increment of Change
Screen 1 of 3	IPAP	4 to 30 cm H_2O	1 cm H_2O
	EPAP	4 to 25 cm H_2O	1 cm H_2O
	Rate	0 to 30 BPM (PC and S/T)	1 BPM
		4 to 30 BPM (T)	1 BPM
Screen 2 of 3	Timed Inspiration	0.5 to 3.0 sec	0.1 sec
	Rise Time	1 to 6	1
Screen 3 of 3	Ramp	Disabled, 0.5, 1.0, 2.0, 3.0 cm H_2O per breath	Discrete values as listed

NOTE: IPAP cannot be set lower than EPAP.

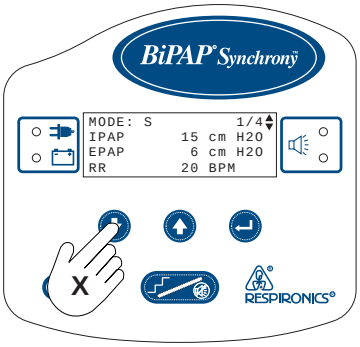
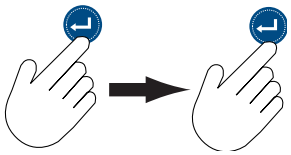
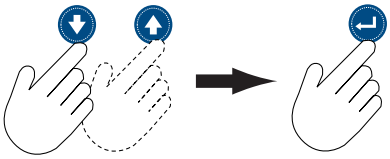
The Rate and Timed Inspiration controls are linked so that the inspiratory time is never longer than the expiratory time. If the Rate or Timed Inspiration are set to values that would cause the I:E ratio to exceed 1:1, the Timed Inspiration is automatically reduced to maintain a 1:1 I:E ratio.

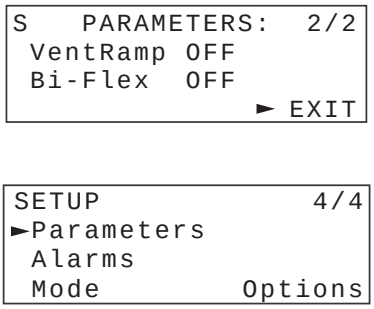
The Rise Time of 1 to 6 corresponds to tenths of a second (e.g., a setting of 4 equals 0.4 seconds rise time).

WARNING! High EPAP pressures could cause discomfort to the patient. Carefully evaluate the patient if you set the EPAP level above 15.

5.3 Changing Synchrony Parameters

This section details the steps required to change parameters while in a given operating mode. For this example, the Synchrony is operating in the S mode.

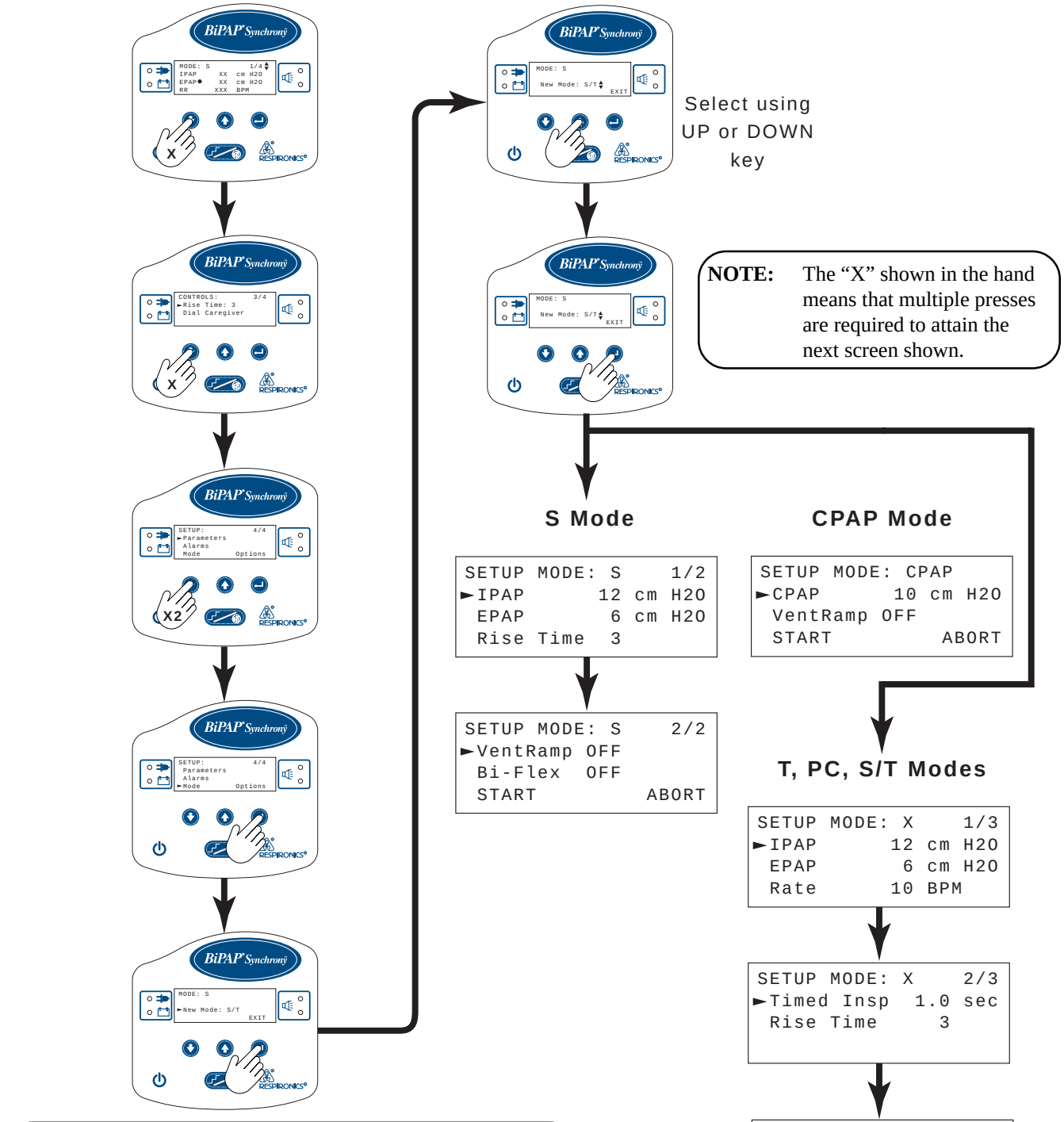
YOUR ACTION	RESULT
STEP 1 From the Monitoring screen, press the DOWN key until the Setup screen is displayed. 	SETUP 4/4 ►Parameters Alarms Mode Options
STEP 2 Press the ENTER key to activate the Change Parameters screen, then press the ENTER key to activate the IPAP parameter for change. 	S PARAMETERS: 1/2 ►IPAP 19 19 cm H2O EPAP 5 5 cm H2O Rise Time 3 S PARAMETERS: 1/2 IPAP 19 19▲▼cm H2O EPAP 5 5 cm H2O Rise Time 3
STEP 3 Press the UP or DOWN key change the value. Each key press changes the value by one increment. Press the ENTER key to select the next parameter. 	S PARAMETERS: 1/2 IPAP 19 15▲▼cm H2O EPAP 5 5 cm H2O Rise Time 3 S PARAMETERS: 1/2 IPAP 15 15 cm H2O ►EPAP 5 5 cm H2O Rise Time 3
STEP 4 Continue changing parameters: press the UP or DOWN key to select a parameter, press the ENTER key to activate the parameter for change, use the UP or DOWN key to change the value, and press the ENTER key to retain the change. When you reach the last parameter on a page, press the DOWN key to scroll to the next page.	**NOTE:** To move from one screen to another, press the DOWN key when the selection indicator is at the last selectable item on the screen; or press the UP key when the selection indicator is at the first item.

YOUR ACTION	RESULT
STEP 5 Scroll to page 2 of the S Parameters screens. Select the EXIT command and press the ENTER key to return to the Setup screen.	

Chapter 6: Changing Modes

6.1 Summary of Change Mode Operations

Full Access Only



NOTE: The "X" shown in the hand means that multiple presses are required to attain the next screen shown.

NOTE: If the backlight is off, the first press of the ▲, ▼, or ↵ key will only turn the backlight on; the normal key action is suppressed until the key is pressed a second time. All procedures assume the backlight is already on.

6.2 Change Mode Setup Screens

6.2.1 CPAP Mode Setup Screen

```
SETUP MODE: CPAP
►CPAP       10 cm H2O
 VentRamp OFF
 START          ABORT
```

See Section 5.2.1 for parameter ranges and increments.

6.2.2 S Mode Setup Screens

```
SETUP MODE: S     1/2
►IPAP       12 cm H2O
 EPAP        6 cm H2O
 Rise Time   3
```

```
SETUP MODE: S     2/2
►VentRamp OFF
 Bi-Flex  OFF
 START          ABORT
```

See Section 5.2.2 for parameter ranges and increments.

6.2.3 T, PC, and S/T Modes Setup Screens

```
SETUP MODE: X     1/3
►IPAP       12 cm H2O
 EPAP        6 cm H2O
 Rate       10 BPM
```

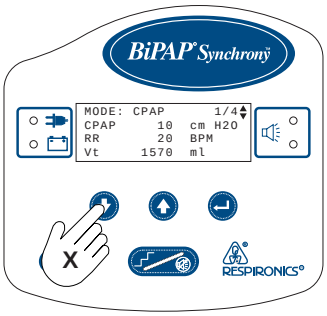
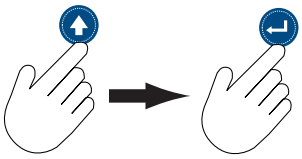
```
SETUP MODE: X     2/3
►Timed Insp  1.0 sec
 Rise Time      3
```

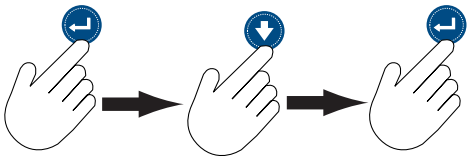
```
SETUP MODE: X     3/3
►VentRamp OFF

 START          ABORT
```

See Section 5.2.3 for parameter ranges and increments.

6.3 Changing the Synchrony Mode

This section details the steps required to change the operating mode. For this example, the Synchrony is operating in the CPAP mode and will be changed to the S mode.

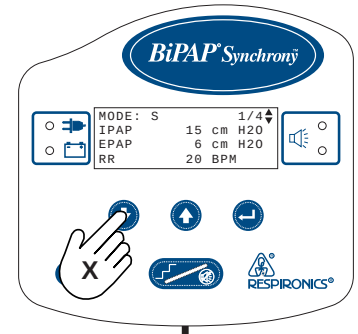
YOUR ACTION	RESULT
STEP 1 From the CPAP monitoring screen, press the DOWN key until the Mode command is selected in the Setup screen. 	SETUP: 3/3 Parameters Alarms ►Mode Options
STEP 2 Press the ENTER key twice to activate the Change Mode screen and the New Mode command.	MODE: CPAP ►New Mode: CPAP EXIT MODE: CPAP New Mode: CPAP ▲▼ EXIT
STEP 3 Press the UP key once to select S, then press the ENTER key to implement the change. 	MODE: CPAP New Mode: S ▲▼ EXIT SETUP MODE: S 1/2 ►IPAP 12 cm H2O EPAP 6 cm H2O Rise Time 3

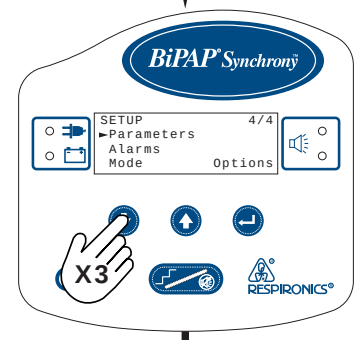
YOUR ACTION	RESULT
STEP 4 a. Press the ENTER key to activate the IPAP parameter for change b. Press the UP or DOWN key to change the IPAP value. Each key press changes the value by one increment (see Section 5.3). c. Press the ENTER KEY to implement the change. 	SETUP MODE: S 1/2 IPAP 12▲▼cm H2O EPAP 6 cm H2O Rise Time 3 SETUP MODE: S 1/2 IPAP 11▲▼cm H2O EPAP 6 cm H2O Rise Time 3 SETUP MODE: S 1/2 IPAP 11 cm H2O ►EPAP 6 cm H2O Rise Time 3
STEP 5 Continue changing parameters: press the UP or DOWN key to select a parameter, press the ENTER key to activate the parameter for change, use the UP or DOWN key to change the value, and press the ENTER key to implement the change.	**NOTE:** To move from one screen to another, press the DOWN key when the selection indicator is at the last selectable item on the screen; or press the UP key when the selection indicator is at the first item.
STEP 6 Scroll to page 2 of 2 and press the DOWN key to select the START command. NOTE: To exit the setup mode without initiating a new mode, press the DOWN key to select the ABORT command, then press the ENTER key.	SETUP MODE: S 2/2 VentRamp OFF Bi-Flex OFF ►START ABORT
STEP 7 Press the ENTER key to implement the S mode at the selected settings. 	MODE: S 1/4▲▼ IPAP 15 cm H2O EPAP 5 cm H2O RR 20 BPM

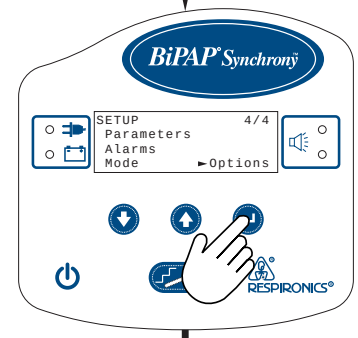
NOTES: The current mode remains active until the START command is implemented with the ENTER key.

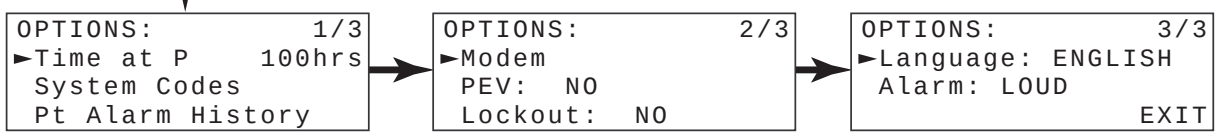
Chapter 7: Options

7.1 Summary of Options Operations









NOTE: The "X" shown in the hand means that multiple presses are required to attain the next screen shown.

NOTE: If the backlight is off, the first press of the ▲, ▼, or ↵ key will only turn the backlight on; the normal key action is suppressed until the key is pressed a second time. All procedures assume the backlight is already on.

7.2 Synchrony Options Menu

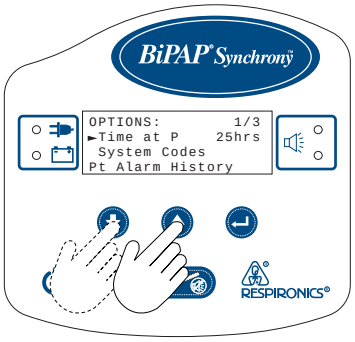
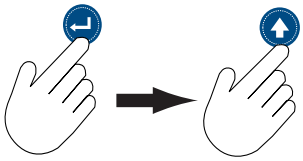
The Options menu allows you to:

- view and reset the Time at P (Time at Pressure)
- view and clear the System Codes and the Pt Alarm History (Patient Alarm History)
- view and change the Modem settings
- adjust leak determination for the Plateau Exhalation Valve (PEV)
- change the access level
- modify the language
- modify the alarm volume

7.2.1 Time at Pressure

The Time at P display shows the time, in hours, that the Synchrony has run at the prescribed pressure. The time is accumulated for bi-level modes when the IPAP pressure is within 2 cm H_2O of the set pressure; for the CPAP mode, time is accumulated when a breath is triggered. The time can be cleared.

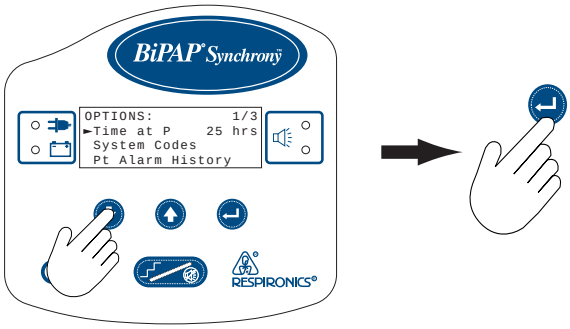
To view or clear the Time at P display:

YOUR ACTION	RESULT
Step 1 From the Options menu, press the UP or DOWN key to select the Time at P display. 	OPTIONS: 1/3 ►Time at P 25hrs System Codes Pt Alarm History
Step 2 Press the ENTER key to activate the Time at P reset screen then press the UP key to select the CLEAR command. 	TIME AT P: 25.1 hours CLEAR ►EXIT TIME AT P: 25.1 hours ►CLEAR EXIT
Step 3 Press the ENTER key to reset the Time at Pressure hours.	OPTIONS: 1/3 ►Time at P 0hrs System Codes Pt Alarm History

7.2.2 System Codes

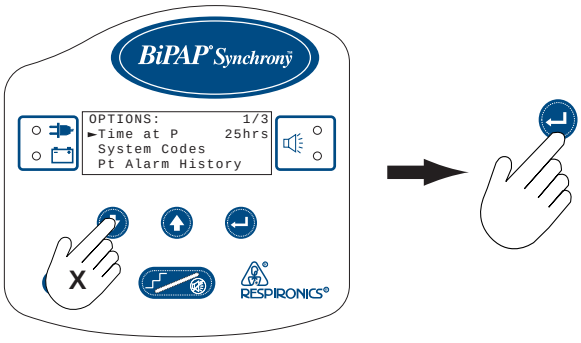
The Synchrony stores the system error codes in the system alarm log. These codes can be used by authorized service representatives to troubleshoot the ventilator. The Synchrony can store five pages of 10 codes per page. Appendix B lists the error codes.

The Error Code Screen also allows you to clear all the currently-stored codes.

YOUR ACTION	RESULT
Step 1 From the Options menu, press the DOWN key until the System Codes command is selected, then press the ENTER key to display the System Codes screen. 	OPTIONS: 1/3 Time at P 50hrs ►System Codes Pt Alarm History SYSTEM CODES: 1/1 067 011 009 CLEAR ►EXIT
Step 2 Press the ENTER key to Exit the screen. If there are more than one page of codes, press the DOWN key to scroll through the screens. The final screen will display the EXIT command. To exit the system codes, press ENTER. To clear the system codes when the CLEAR command is displayed, press the UP key then the Enter key.	OPTIONS: 1/3 ►Time at P 50hrs System Codes Pt Alarm History

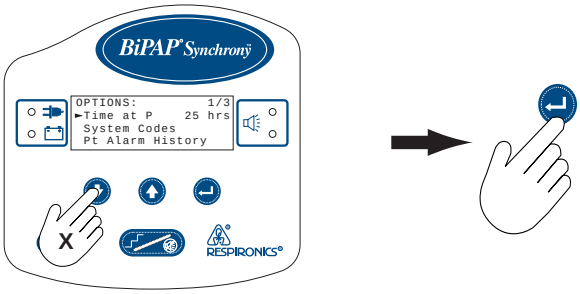
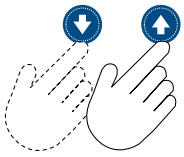
7.2.3 PATIENT ALARM HISTORY

The Synchrony stores the patient alarms such that the most recent alarm appears first in the patient alarm log. The Synchrony can store 20 pages with two alarm messages per page.

YOUR ACTION	RESULT
STEP 1 From the Options menu, press the DOWN key until the Patient Alarm History command is selected, then press the ENTER key to activate. 	OPTIONS: 1/3 Time at P 25hrs System Codes ►Pt Alarm History PT ALARMS: 1/1 Apnea CLEAR ►EXIT
STEP 2 Press the ENTER key to Exit the screen. If there are more than one page of history, press the DOWN key to move to the Exit screen, then press ENTER. To clear the alarm history when the CLEAR command is displayed, press the UP key then the Enter key.	OPTIONS: 1/3 Time at P 25hrs System Codes ►Pt Alarm History

7.2.4 MODEM SETTINGS

The Modem Settings screens display and allow you to change the modem type (external or internal), modem speed, phone number to be dialed, and the modem initialization string. (See Appendix A for external modem considerations.)

YOUR ACTION	RESULT
STEP 1 From the Options menu, press the DOWN key until the Modem command is selected, then press the ENTER key to activate the Modem Settings screen. 	OPTIONS: 2/3 ►Modem PEV: NO Lockout: NO MODEM SETTINGS: 1/6 ►Type: Ext. 19200 Dial: ATDT*70,4125551212
STEP 2 Press the ENTER key to activate the Type for change.	MODEM SETTINGS: 1/6 Type: Ext. 19200 ▲▼ Dial: ATDT*70,4125551212
STEP 3 Press the UP or DOWN key to toggle the modem types. 	The choices are: • Internal • External 57600 • External 38400 • External 19200 • External 9600 • External 2400 • None **NOTE:** For all screens, you can hold in the UP or DOWN key to quickly scroll through the choices.
STEP 4 Press the ENTER key when your modem type is displayed. If your Synchrony was purchased with the optional internal modem, select Internal.	MODEM SETTINGS: 1/6 Type: Ext. 19200 ►Dial: ATDT*70,4125551212

NOTE: In the remainder of the modem setup steps, you can select a ↵ character in the text string selections. If you press the ENTER key when the ↵ is displayed, all characters to the right of the ↵ are deleted; all characters to the left of the ↵ are accepted.

YOUR ACTION	RESULT
STEP 5 Press the ENTER key to activate the Dial parameters for change. 	MODEM SETTINGS: 1/6 Type: Ext. 19200 Dial: ATDT▲▼70,4125551212
STEP 6 The first parameter under Dial sets the type of line service the patient will be using. Press the UP or DOWN key to scroll through the options: • ATDT for tone dialing • ATDP for pulse dialing • ↵ to leave the phone number blank Press the ENTER key when the desired setting is displayed. The Navigation Indicator moves one character to the right.	MODEM SETTINGS: 1/6 Type: Ext. 19200 Dial: ATDT*▲▼0,4125551212
STEP 7 The remaining characters are selected one at a time, and are used to set the number to dial. This includes any prefixes, such as *70. Use the UP or DOWN arrow keys to scroll through: • 1 to 9 • * (asterisk) • , (comma) • ↵ (enter) Press the ENTER key when the desired character is displayed; the Navigation Indicator moves one character to the right.	**NOTE:** The comma is used to place a pause between inputs, such as after *70; the * is used to access special phone options, such as disabling call waiting. No dashes are used in the phone number. The maximum number of characters is 15. MODEM SETTINGS: 1/6 Type: Ext. 19200 Dial: ATDT*7▲▼,4125551212
STEP 8 At the final digit of the phone number, press the ENTER key to move one character to the right; scroll to the ↵ symbol. Press the ENTER key, then the DOWN key. The Modem Settings screen scrolls to page 2 of 6.	MODEM SETTINGS: 1/6 Type: Ext. 19200 Dial: ATDT*70,4125551212↵▲▼ MODEM SETTINGS: 2/6 ►INIT 1: AT&FV0E1Q0

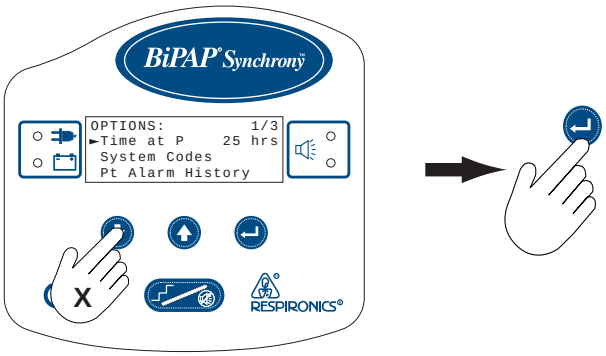
YOUR ACTION	RESULT
STEP 9 If you have the internal modem installed, the modem initialization strings are automatically entered, and cannot be changed. Press the DOWN key twice and skip to Step 11. For external modems, see Appendix A for recommended initialization strings. Press the ENTER key to activate the Initialization String 1 for change. The navigation of the string works the same as for the phone number entry of Step 7, except the character set is: • A to Z • = (equal) • 0 to 9 • + (plus) • & (ampersand) • - (minus) • % (percent) • \ (backslash) • # (pound sign) • ↵ (enter) The maximum number of characters is 20. When you have entered the desired initialization string, move one character to the right, scroll to the ↵ symbol, and press the ENTER key then press the DOWN key. The screen scrolls to Page 3 of 6, Init 2.	MODEM SETTINGS: 3/6 ►INIT 2: AT&FV0E1Q0
STEP 10 Enter the Init 2 string as shown in Appendix A. The navigation and change operation is the same as in Step 9. The maximum number of characters is 20. When you have entered the desired initialization string, move one character to the right, scroll to the ↵ symbol, and press the ENTER key. The screen scrolls to page 4 of 6, Patient ID.	MODEM SETTINGS: 4/6 ►Patient ID: MR. SMITH
STEP 11 The Patient ID screen is used to identify the patient for your records. The navigation of the ID string works the same as for the phone number in Step 7, except the character set is: • A to Z • (space) • 0 to 9 • - (minus) • _ (underscore) • . (period) • # (pound sign) • ↵ (enter) **NOTE:** The patient ID text will appear on the start-up screen. (See Section 4.3).	

YOUR ACTION	RESULT
The maximum number of characters is 20. When you have entered the desired initialization string, move one character to the right, scroll to the ↵ symbol, and press the ENTER key. The screen scrolls to page 5 of 6, Provider.	MODEM SETTINGS: 5/6 ►Provider: HEALTH CARE
STEP 12 The Provider screen is used to identify your company to the patient. It is shown in place of "Provider" in the Call Provider screen. The navigation of the ID string and the character set are the same as for the Patient ID of Step 10. The maximum number of characters is 20. When you have entered the desired initialization string, move one character to the right, scroll to the ↵ symbol, and press the ENTER key then press the DOWN key. The screen scrolls to page 6 of 6, Serial Number.	MODEM SETTINGS: 6/6 Serial Number: 012345 ►EXIT
STEP 13 The Serial Number is the serial number of the Synchrony. It is factory-set and cannot be changed. You may use the number for tracking purposes. Press the ENTER key to exit the Modem Setting screens and return to the Options menu. 	OPTIONS: 2/3 ►Modem PEV: NO Lockout: NO

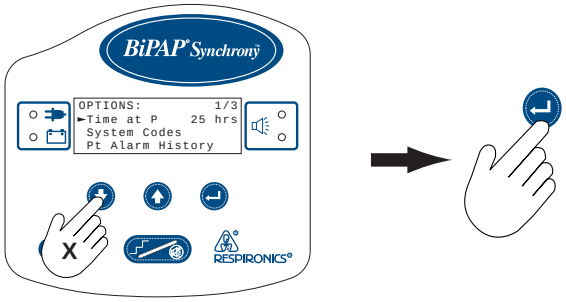
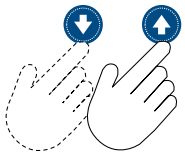
7.2.5 PEV SETTING

The PEV parameter is provided to compensate for the different leak characteristics when using a Respironics Plateau Exhalation Valve (PEV). The PEV setting is stored in memory and must be changed if you are changing from or to a PEV after restarting the Synchrony.

WARNING: The PEV parameter must be set to YES if a PEV is in the patient circuit. Failure to set the parameter correctly can result in inaccurate leak and tidal volume measurements.

YOUR ACTION	RESULT
STEP 1 From the Options menu, press the DOWN key until the PEV parameter is selected, then press the ENTER key. 	OPTIONS: 2/3 Modem PEV: NO Lockout: NO
STEP 2 Press the UP or DOWN key to toggle the value of the PEV parameter.	OPTIONS: 2/3 Modem PEV: YES Lockout: NO
STEP 3 Press the Enter key to accept the change to the PEV parameter.	OPTIONS: 2/3 Modem PEV: YES ►Lockout: NO

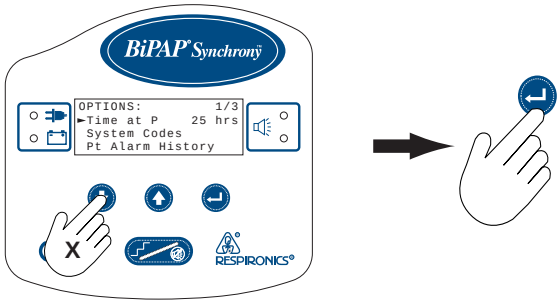
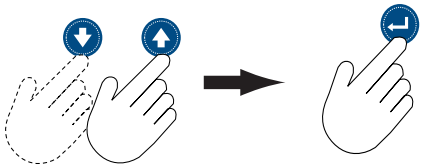
7.2.6 Changing the Access Level

YOUR ACTION	RESULT
Step 1 From the Options menu, press the DOWN key until the Lockout command is selected, then press the ENTER key. 	OPTIONS: 2/3 Modem PEV: YES ►Lockout: NO OPTIONS: 2/3 Modem PEV: YES Lockout: NO▲▼
Step 2 Press the UP or DOWN key to toggle the Lockout command between YES and NO. 	OPTIONS: 2/3 Modem PEV: YES Lockout: YES▲▼
Step 3 Press the ENTER key to implement the Lockout command.	OPTIONS: 2/3 Modem PEV: YES ►Lockout: YES **NOTE:** The Lockout command change does not take effect until you exit the Options menu.

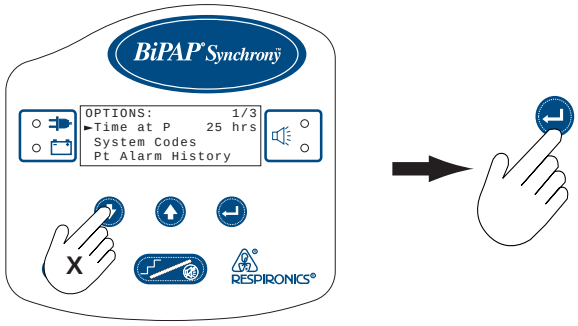
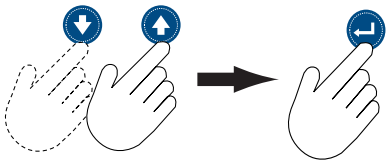
7.2.7 Unlocking the Access Level

After the unit is set to Lockout, you may access the Setup screen by simultaneously pressing and holding the RAMP and ENTER keys for one second.

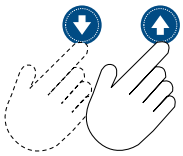
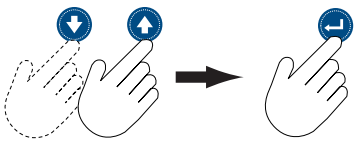
7.2.8 CHANGING THE LANGUAGE

YOUR ACTION	RESULT
STEP 1 From the Options menu, press the DOWN key until the Language command is selected, then press the ENTER key. 	OPTIONS: 3/3 ►Language: ENGLISH Alarm: LOUD EXIT OPTIONS: 3/3 Language: ENGLISH▲▼ Alarm: LOUD EXIT
STEP 2 Press the UP or DOWN key to scroll through the available languages, then press the ENTER key to implement the language change. 	OPTIONS: 3/3 Language: FRANÇAIS▲▼ Alarm: LOUD EXIT OPTIONS: 3/3 Langue: FRANÇAIS Volume Alarm: HAUT ►SORTIE

7.2.9 Changing the Alarm Volume

YOUR ACTION	RESULT
Step 1 From the Options menu, press the DOWN key until the Alarm command is selected, then press the ENTER key. 	OPTIONS: 3/3 Language: ENGLISH ►Alarm: LOUD EXIT OPTIONS: 3/3 Language: ENGLISH Alarm: LOUD▲▼ EXIT
Step 2 Press the UP or DOWN key to toggle between LOUD and SOFT, then Press the ENTER key to implement the Alarm volume change. 	OPTIONS: 3/3 Language: ENGLISH Alarm: SOFT▲▼ EXIT OPTIONS: 3/3 Language: ENGLISH Alarm: SOFT ►EXIT

7.2.10 Exiting the Options Menu

YOUR ACTION	RESULT
Step 1 Press the UP or DOWN key to return to Options screen 3/3. 	OPTIONS: 3/3 ►Language: ENGLISH Alarm: LOUD EXIT
Step 2 Press the UP or DOWN key to select EXIT, then press the ENTER key. 	OPTIONS: 3/3 Language: ENGLISH Alarm: LOUD ►EXIT

Chapter 8: Alarms

This chapter describes the Synchrony alarms, describes how to set them, and lists corrective actions for the alarm conditions.

8.1 Alarm Introduction

The Synchrony provides three alarm levels: high, medium, and low priority.

High priority alarms require immediate operator response. The alarm signal consists of a red LED and a high priority sound. The display has the message “ALARM” at the top of the screen.

Medium priority alarms require prompt operator response. The alarm signal consists of a yellow LED and a medium priority sound. The display has the message “WARNING” at the top of the screen.

Low priority alarms require operator awareness. The alarm signal consists of a yellow LED and a low priority sound. The display has the message “INFO” at the top of the screen.

Some audible indicators are self-cancellable. This means that the alarm sound will stop when the cause of the alarm is corrected. See Section 8.3 for detailed descriptions of the alarm LEDs and sounds.

Figure 8-1 identifies the alarm LED locations on the control panel.

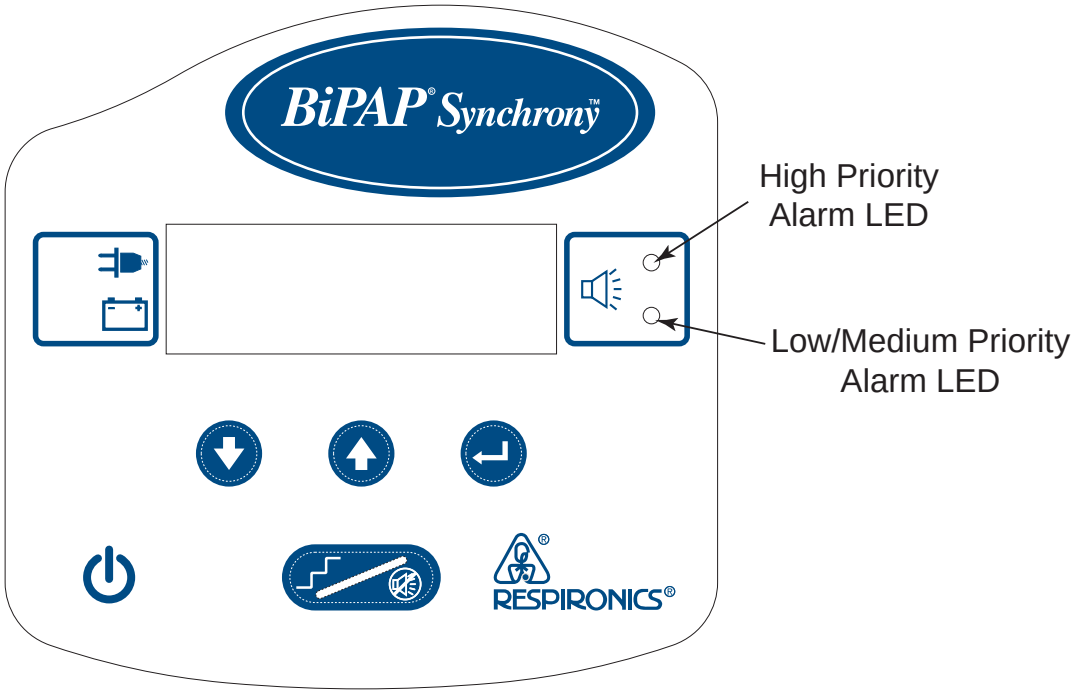
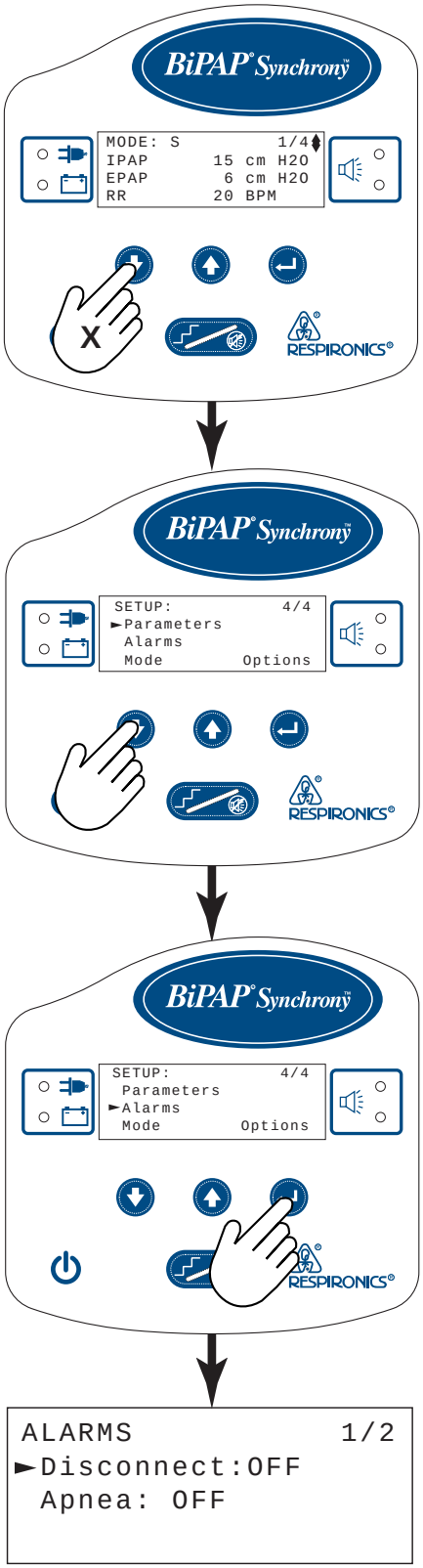


Figure 8-1 Synchrony Alarm Indicators

8.2 Setting Alarm Parameters

8.2.1 Alarm Parameter Operation Summary



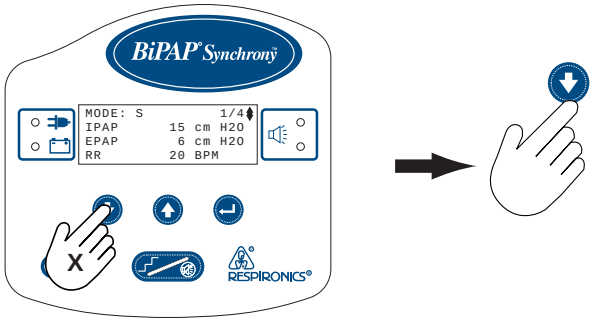
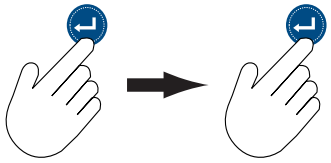
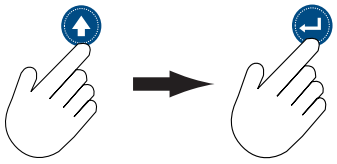
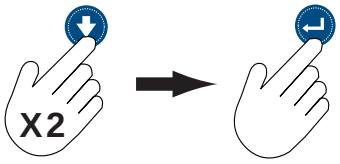
NOTE: The "X" shown in the hand means that multiple presses are required to attain the next screen shown.

NOTE: If the backlight is off, the first press of the ▲, ▼, or ↵ key will only turn the backlight on; the normal key action is suppressed until the key is pressed a second time. All procedures assume the backlight is already on.

8.2.2 Changing the Alarm Parameters

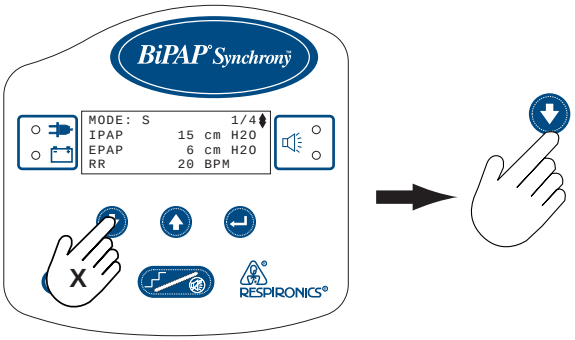
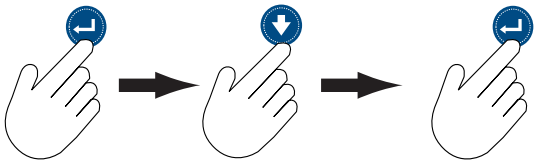
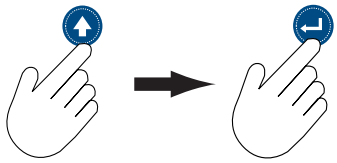
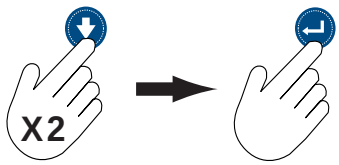
The Patient Disconnect Alarm Delay, the Apnea Alarm, and the Low Minute Ventilation Alarm are adjustable on the Synchrony. When any of these alarms are enabled, an inverse "A" appears at the top of the Monitoring screen. See Chapter 3 for details.

Changing the Patient Disconnect Alarm Delay

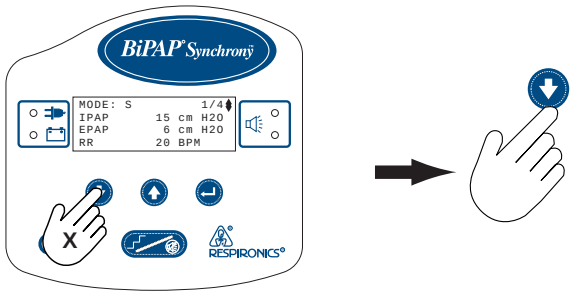
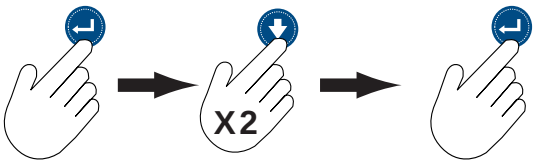
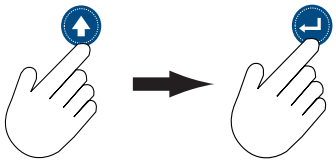
YOUR ACTION	RESULT
Step 1 From the Monitoring screen, press the DOWN key until the Alarms command is selected. 	SETUP 4/4 Parameters ►Alarms Mode Options
Step 2 Press the ENTER key to activate the Alarms screen, then press the ENTER key again to activate the Disconnect parameter for change. 	ALARMS ►Disconnect:OFF Apnea:OFF ALARMS 1/2 Disconnect:OFF Apnea: OFF
Step 3 Press the UP or DOWN key to change the parameter, then press the ENTER key to implement the change. 	The settings are OFF, 15 seconds, and 60 seconds. ALARMS Disconnect: 15 sec Apnea: OFF ALARMS Disconnect: 15 sec ►Apnea: OFF
Step 4 Press the DOWN key twice, the press the ENTER key to exit the Alarms screen. 	ALARMS 2/2 LowMinVent:25 L/MIN ►EXIT SETUP 4/4 Parameters ►Alarms Mode Options

Changing the Apnea Alarm

NOTE: If you disable the apnea alarm, the system will not produce an audible alarm. A record of the apnea will not appear in the Synchrony alarm log. However a record will appear in the Encore/ Encore Pro alarm log.

YOUR ACTION	RESULT
Step 1 From the Monitoring screen, press the DOWN key until the Alarms command is selected. 	SETUP 4/4 Parameters ►Alarms Mode Options
Step 2 Press the ENTER key to display the Alarms screen, press the DOWN key to select the Apnea parameter, then press the ENTER key to activate. 	ALARMS 1/2 Disconnect:OFF Apnea: OFF
Step 3 Press the UP or DOWN key to change the parameter, then press the ENTER key to implement the change. 	The settings are OFF, 10, 20, 30, 40 seconds. ALARMS 1/2 Disconnect: 15 sec Apnea: OFF EXIT ALARMS 1/2 Disconnect: 15 sec ►Apnea: 20 sec
Step 4 Press the DOWN key twice, then press the ENTER key to exit the Alarms screen. 	ALARMS 2/2 LowMinVent:25 L/MIN ►EXIT SETUP 4/4 Parameters ►Alarms Mode Options

Changing the Low Minute Ventilation Alarm

YOUR ACTION	RESULT
Step 1 From the Monitoring screen, press the DOWN key until the Alarms command is selected. 	SETUP 4/4 Parameters ►Alarms Mode Options
Step 2 Press the ENTER key to display the Alarms screen, press the DOWN key twice to select the LowMinVent parameter, then press the ENTER key to activate. 	ALARMS 2/2 LowMinVent:OFF EXIT
Step 3 Press the UP or DOWN key to change the parameter, then press the ENTER key to implement the change. 	The settings are OFF, 1 to 99 L/MIN. ALARMS 2/2 LowMinVent:20 L/MIN EXIT ALARMS 2/2 LowMinVent:25 L/MIN ►EXIT
Step 4 Press the ENTER key to exit the Alarms screen.	SETUP 4/4 Parameters ►Alarms Mode Options

8.3 Summary of Alarm Behavior

Alarm conditions are signaled by the Synchrony in three ways: a sound, an LED, and a display message. Each signal type behaves differently depending on the type of alarm.

8.3.1 Alarm Sounds Behavior

High Priority Sounds:

High Priority: The sound repeats a pattern of three beeps followed by two beeps until the RAMP/SILENCE key is pressed. The silence period is one minute. This pattern is indicated in Section 8.5 by ●●● ●●

Loss of Power: The sound is continuous for two minutes without user intervention. If the user presses the STANDBY key, the sound will terminate. There is no silence period for this sound. This pattern is indicated in Section 8.5 by ▬▬▬

Synchrony Failure: In the event of a Synchrony failure, the alarm sounds in single beeps until power is removed from the Synchrony. It cannot be silenced except by removing power. This pattern is indicated in Section 8.5 by ● ● ●

Medium Priority Sound:

The sound repeats a pattern of three beeps every 20 seconds until the RAMP/SILENCE key is pressed. The silence period is one minute. The pattern is indicated in Section 8.5 by ●●●

Low Priority Sound:

The alarm repeats a pattern of two beeps every 30 seconds until the RAMP/SILENCE key is pressed. The audible alarm will not reoccur. The pattern is indicated in Section 8.5 by ●●

Silence Period

The alarm silence period, when applicable, is one minute. When the alarm sound is silenced, a flashing LED becomes continuous (see 8.3.2). If the alarm condition is not corrected by the end of the silence period, the alarm sound is repeated; the LED is not affected. If a new high or medium priority alarm condition occurs during this time, the appropriate LED will flash. New low priority alarms will not cause the LED to flash.

8.3.2 Alarm LED Behavior

Red LED

- Flashing red LED indicates a new high priority alarm. The LED changes to continuous when the alarm sound is silenced or the alarm condition is corrected. The LED will resume flashing during the silence period if a new alarm occurs. The LED goes off when the alarm message is cleared.
- Continuous red LED indicates a loss of power or a silenced high priority alarm.

Yellow LED

- Flashing yellow LED indicates a new medium priority alarm. The LED changes to continuous when the alarm sound is silenced or the alarm condition is corrected. The LED will resume flashing during the silence period if a new medium priority alarm occurs. The LED goes off when the alarm message is cleared.
- Continuous yellow LED indicates a low priority alarm or a silenced medium priority alarm.

8.3.3 Display Behavior

The ● indicator is displayed next to an alarm message to indicate an active alarm condition. When the condition is corrected, the ● indicator is cleared.

For High Priority Alarms, the displays shows “ALARM” and the name of the alarm.

For Medium Priority Alarms, the display shows “WARNING” and the name of the alarm.

For Low Priority Alarms, the display shows “INFO” and the name of the alarm.

The display can contain multiple pages of alarms. The page number in the upper right of the display will indicate the page you are on and the total pages (e.g., 1/3). To access the other pages, press the UP or DOWN key.

8.4 Summary of User Actions During Alarm

The following steps apply to most alarm conditions. The patient or operator should follow this sequence unless otherwise directed by the alarm table in Section 8.5.

STEP 1 Look at the alarm indicators and listen to the alarm sound.

(Note color and whether LED is flashing or solid)

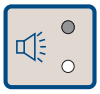
STEP 2 Look at the display for text.

```
ALARM              1/1
●Apnea
```

If more than one alarm is listed, the ● indicator shows which alarm is still active.

STEP 3 Press the RAMP/SILENCE key.

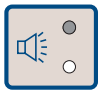
```
ALARM              1/1
●Apnea
                ►CLEAR
```



Alarm CLEAR Screen is displayed
Alarm LED is solid

STEP 4 Press the Enter key to clear the alarm.

```
ALARM              1/1
 Apnea
                ►CLEAR
```

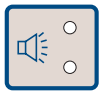


● indicator is off
Alarm LED is solid

NOTE: For High and Medium Priority Alarms, the ● indicator will go off when the alarm condition is corrected.

STEP 5 Look up the alarm in the alarm tables and perform the Patient Action.

```
MODE: S            1/4▲▼
IPAP         15 cm H2O
EPAP          6 cm H2O
RR           20 BPM
```



Alarm is reset
Display returns to screen that was showing at time of alarm

8.5 Alarm Tables

Sections 8.5.1 to 8.5.3 detail the alarms, display messages, Synchrony actions, possible causes, and patient and provider actions. The tables are arranged alphabetically, by priority. Note that the LED and Audible columns represent the conditions when the alarm is activated; all LEDs will be on and the audible will be silenced after you press the RAMP/ SILENCE key. Section 8.5.4 provides definitions for the alarms.

8.5.1 High Priority Alarms

LED	Audible	Display Message	Synchrony Action	Possible Cause	Patient Action	Provider Action
Red Flash	● ● ●	Blank Screen	Shuts down	Device failure.	Cannot be silenced; remove power from the device, and contact home care provider.	Replace the device.
Red Solid	▬▬▬	Blank Screen	Shuts down	Power was lost while the device was providing therapy.	Press ⏻ to silence, restore power.	None.
Red Flash	●●● ●●	Apnea[1]	Operates	Apnea event occurred during therapy.	Report alarm to your home care provider.	Verify patient status.
Red Flash	●●● ●●	High Pressure	Operates	Malfunctioning device.	None. If alarm continues call your home care provider.	Replace device.
Red Flash	●●● ●●	Invalid Prescription Call Provider	Shuts down	The prescription data is corrupted.	Do not use the device; call your home care provider.	Re-enter prescription data or replace the device.
Red Flash	●●● ●●	Low Pressure	Operates	Excessive leak or blockage.	Check for the following: dirty inlet filters, blocked air intake, excessive leak in patient circuit. If alarm continues, call your home care provider.	Replace the device.
Red Flash	●●● ●●	Patient Disconnect[1]	Operates	Patient circuit is disconnected or has a large leak.	Reconnect the patient circuit or correct the leak. NOTE: If therapy does not resume after you start breathing, (1) silence the alarm using the RAMP key, (2) clear the alarm using the ENTER key, and (3) press the RAMP key again to resume therapy. If the alarm continues, contact your home care provider.	Reconnect the patient circuit or fix the leak. If the alarm continues, replace the device.

[1] Optional

LED	Audible	Display Message	Synchrony Action	Possible Cause	Patient Action	Provider Action
Red Flash	●●● ●●	Low Pressure Support	Operates	Device is malfunctioning.	Call your home care provider.	Replace the device.
Red Flash	●●● ●●	Low Minute Ventilation[1]	Operates	Device sensed minute ventilation below alarm setpoint.	Report alarm to your home care provider.	Verify patient status.
Red Flash	●●● ●●	Ventilator Inoperative (Displays Codes)[2]	Shuts down	Internal device failure.	Remove power from the device. Call your home care provider.	Replace the Synchrony.
Red Flash	●●● ●●	Ventilator Inoperative Battery Failure	Shuts down	Battery is discharged.	Remove DC power source from the Synchrony, replace the battery, restore power to the Synchrony; or seek reliable AC power source.	Replace the battery.

[1] Optional

[2] The error codes can be viewed upon start-up of the Synchrony on the self-test screen. The codes can also be viewed by displaying the System Codes screen as described in Section 7.2.2. Appendix B lists the error codes and their descriptions.

8.5.2 MEDIUM PRIORITY ALARMS

LED	Audible	Display Message	Synchrony Action	Possible Cause	Patient Action	Provider Action
Yellow Flash	●●●	Battery Voltage Too High	Operates	Wrong or malfunctioning battery or charger.	Remove DC power from the device, use on AC, or call home care provider.	Replace the battery.
Yellow Flash	●●●	Low Battery	Operates	Battery nearly discharged.	If on battery, replace battery; if on AC, exchange the battery and charge.	Replace the battery.

8.5.3 LOW PRIORITY ALARMS

LED	Audible	Display Message	Synchrony Action	Possible Cause	Patient Action	Provider Action
Yellow Solid	●●	Battery in Use	Operates	On start-up, information message that battery is being used to provide power.	Press ↵ to confirm that you wish to operate on battery power.	None.
Yellow Solid	●●	Call for Service[1] (Codes are displayed)	Operates	Minor internal error.	Continue to use, write down error code, call your home care provider.	Record the error code or message, replace the unit.
Yellow Solid	●●	Momentary Loss of Power	Operates	Power was lost for less than two minutes while the Synchrony was providing therapy.	Press ↵ to clear the information message.	None.
Yellow Solid	●●	Power Failure, Battery in Use	Operates	Line (AC) power was lost, the device is now operating on battery (DC) power.	Check AC power, seek reliable power source.	None.

[1] The error codes can be viewed upon start-up of the Synchrony on the self-test screen. The codes can also be viewed by displaying the System Codes screen as described in Section 7.2.2. Appendix B lists the error codes and their descriptions.

8.5.4 ALARM DEFINITIONS

The following table lists each patient alarm with its purpose, detection parameters, and termination parameters.

Alarm	Purpose	Detection	Termination
Apnea	The apnea alarm detects the cessation of spontaneous breathing.	Alarm is detected when the time between spontaneous breaths exceeds the Apnea alarm time setting. The alarm is not detected during Flow Limit Control (FLC).	The alarm is terminated when two consecutive spontaneous breaths occur within the Apnea alarm time setting.
High Pressure	The high pressure alarm limits pressure to the patient.	Alarm is detected when the pressure exceeds the IPAP setpoint by 5 cm H_2O for a continuous 0.5 second.*	The alarm is terminated when the pressure is within 5 cm H_2O of the IPAP setpoint for a continuous 0.5 second.
Low Pressure	The low pressure alarm detects when the patient is not receiving adequate pressure therapy.	Alarm is detected when the pressure is below 5 cm H_2O for 60 continuous seconds.	The alarm is terminated when the pressure is within 5 cm H_2O for a continuous 0.5 second.
Patient Disconnect	The patient disconnect alarm detects when the patient is no longer connected to the Synchrony.	Alarm is detected when the Synchrony is in FLC and the Patient Disconnect Alarm is enabled. There is a 10-second delay between the time the Synchrony enters FLC and the alarm is generated.	The alarm is terminated when the Synchrony is no longer in FLC.
Low Pressure Support	The low pressure support alarm detects when the patient is not receiving adequate pressure therapy.	Alarm is detected when R_XPS - MeasPS > PSmin cm H_2O for 60 continuous seconds.**	Alarm is terminated when R_XPS - MeasPS ≤ PSmin cm H_2O for 5 continuous seconds.
Low Minute Ventilation	The low minute ventilation alarm detects when the user is not receiving a specified volume of air on a per minute basis.	Alarm is detected when the calculated minute ventilation ≤ the alarm setting. The alarm is not detected during FLC. Synchrony waits 6 breaths after machine is started or after exiting FLC before detection.	Alarm is terminated when the calculated minute ventilation > the alarm setting.

* The Synchrony shuts down if the pressure exceeds IPAP by 5 cm H_2O for 10 seconds.

** MeasPS = Measured Pressure Support (Attained IPAP - Attained EPAP); R_XPS = Prescription Pressure Support; PSmin = (R_xPS + 2 cm H_2O)/3
The following conditions must be satisfied for the Synchrony to be examined for a Low Pressure Support condition:
- R_XPS > 3 cm H_2O and R_XPS < 10 cm H_2O
- The Synchrony is not performing the Ramp function
- The Synchrony is not in FLC
- The respiratory rate is non-zero

Chapter 9: Communications

This chapter describes the ability of the Synchrony to communicate with the caregiver using the optional modem.

9.1 Communicating Via Optional Modem

The modem setup is described in Chapter 7.

Section 4.5.2 provides instructions to connect the Synchrony to a phone line and dial the provider.

9.2 Communicating With Encore® or Encore Pro Data Management Software

NOTE: Respironics Encore or Encore Pro software is required to extract compliance data.

The Encore or Encore Pro software can extract compliance data from the Synchrony. Use the Respironics-supplied RS-232 cable to connect the Synchrony to an IEC950, EN60950, or UL1950 approved device or computer with the Encore or Encore Pro software loaded. Figure 9-1 shows a typical setup.

See the Encore or Encore Pro software help files for information on running the software.

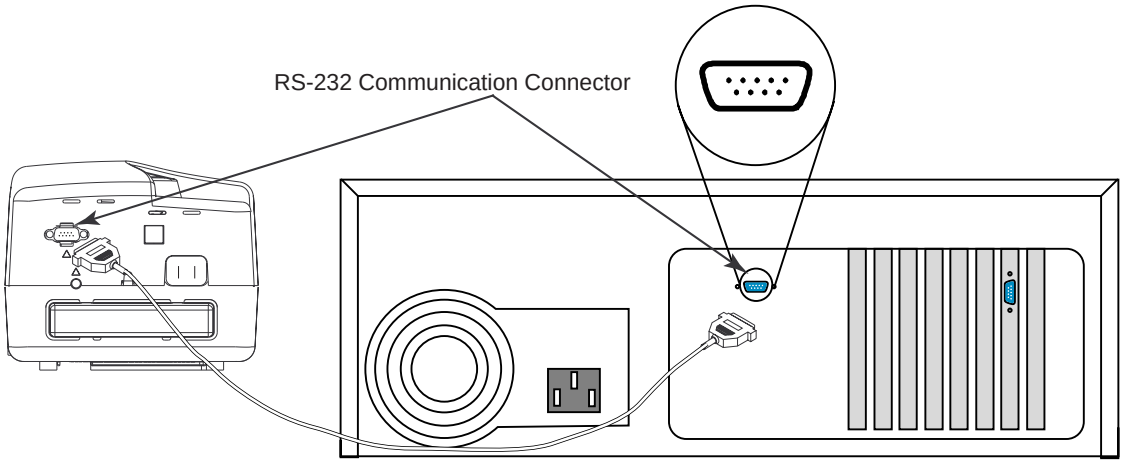


Figure 9-1 Typical Configuration for connecting a Synchrony to a Computer.

Chapter 10: Adding Supplemental Oxygen

You may add oxygen to the patient circuit using the optional oxygen valve. This chapter describes the method of oxygen delivery and shows the oxygen concentrations attained at various IPAP and EPAP settings and oxygen flow rates.

WARNING: Oxygen should be administered only on the order of a physician.

WARNING: Supplemental oxygen should not be added to the breathing circuit by placing the source where the gas will be entrained through the inlet filter on the rear of the device.

WARNING: Never attach oxygen tubing or any positive pressure source to the Pressure Line Port on the front panel of the Synchrony ventilator.

WARNING: Continuous patient monitoring is recommended while administering oxygen. Patient monitoring should consist of, at a minimum, patient observation and pulse oximetry. Arterial blood gas measurements should be used when necessary.

WARNING: Oxygen supports combustion. Oxygen should not be used while the patient is smoking or in the presence of an open flame.

WARNING: When administering fixed-flow supplemental oxygen, the oxygen concentration may not be constant. The inspired oxygen concentration will vary, depending on the IPAP and EPAP settings, patient breathing pattern, and the leak rate. Substantial leaks around the mask may reduce the inspired oxygen concentration to less than the expected concentrations shown in Section 10.2. Appropriate patient monitoring should be implemented.

WARNING: When you are using oxygen with this system, the oxygen supply must comply with the local regulations for medical oxygen.

WARNING: If oxygen is used with the Synchrony, the oxygen flow must be turned off when the Synchrony is not operating.

Explanation of the Warning: When the ventilator is not in operation, and the oxygen flow is left on, oxygen delivered into the ventilator tubing may accumulated within the ventilator enclosure. Oxygen accumulated in the ventilator enclosure will create a risk of fire. This warning applies to most types of bi-level devices.

WARNING: Oxygen accelerates fires. Keep the Synchrony and the oxygen container away from heat, open flames, any oily substance, or other sources of ignition. DO NOT smoke in the area near the Synchrony or the oxygen.

WARNING: If supplemental oxygen is added to the breathing circuit, the optional oxygen valve must be installed and used as shown in Figure 10-1.

10.1 Adding Supplemental Oxygen

WARNING: If supplemental oxygen is added to the breathing circuit, the optional oxygen valve must be installed and used as shown in Figure 10-1.

The delivered oxygen concentration varies with changes in flow in the circuit. The following may have an impact on oxygen concentration:

- Pressure settings
- Patient Tidal Volume
- Peak Inspiratory Flow
- I:E Ratio
- Respiratory rate
- Circuit leak rate
- Oxygen flow rate
- Site where oxygen is added to the circuit.

To add oxygen to the circuit, the oxygen supply must comply with the local regulations for medical oxygen. The oxygen flow into the oxygen valve cannot exceed 15 L/min and the pressure cannot exceed 50 psi.

Step 1 As shown in Figure 10-1, attach oxygen tubing from the oxygen source to the “In” port on the oxygen valve.

Step 2 Connect a section of oxygen tubing to the “Out” valve port, then to one of the ports on the mask (if so equipped) or to an O_2 enrichment adaptor positioned in the patient circuit.

Step 3 Turn the Synchrony on.

Step 4 Set the oxygen flow to the desired value.

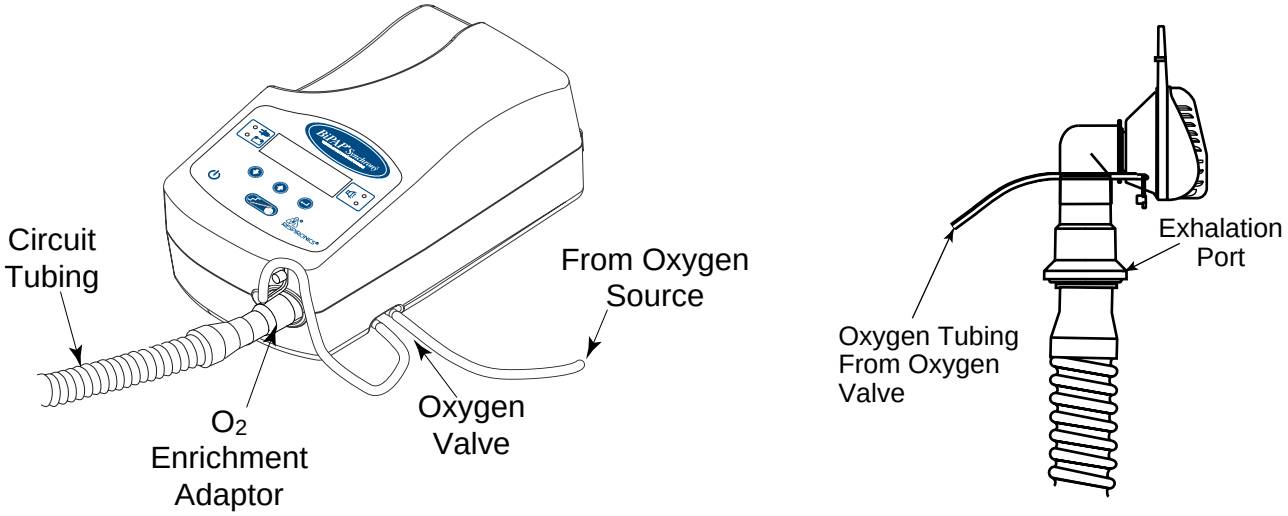


Figure 10-1 Methods of Adding Oxygen to the Patient Circuit

10.2 Supplemental Oxygen Concentrations

Figures 10-2 and 10-3 illustrate the potential range of oxygen concentration available to the patient at a given tidal volume, supplemental oxygen flow, and pressure setting. These figures represent bench test results without inadvertent mask leaks when oxygen is administered at the mask. Substantial leaks around the mask may reduce the expected oxygen concentration to below the levels shown in Figures 10-2 and 10-3. This guideline may be used as a starting point for initiating oxygen therapy. Oxygen flow should be gradually adjusted until the patient's oxygen needs are adequately met.

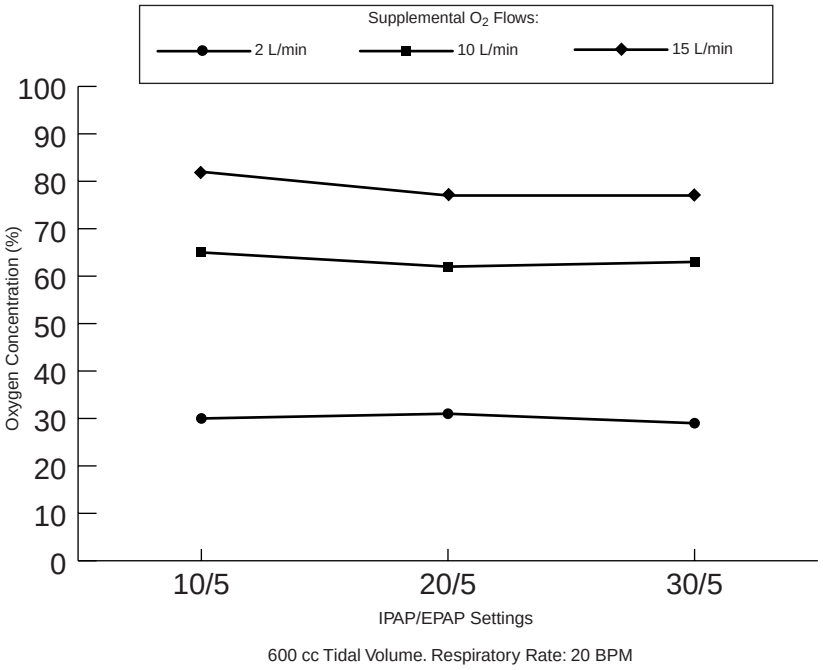


Figure 10-2 Oxygen Concentration for 600cc Tidal Volume

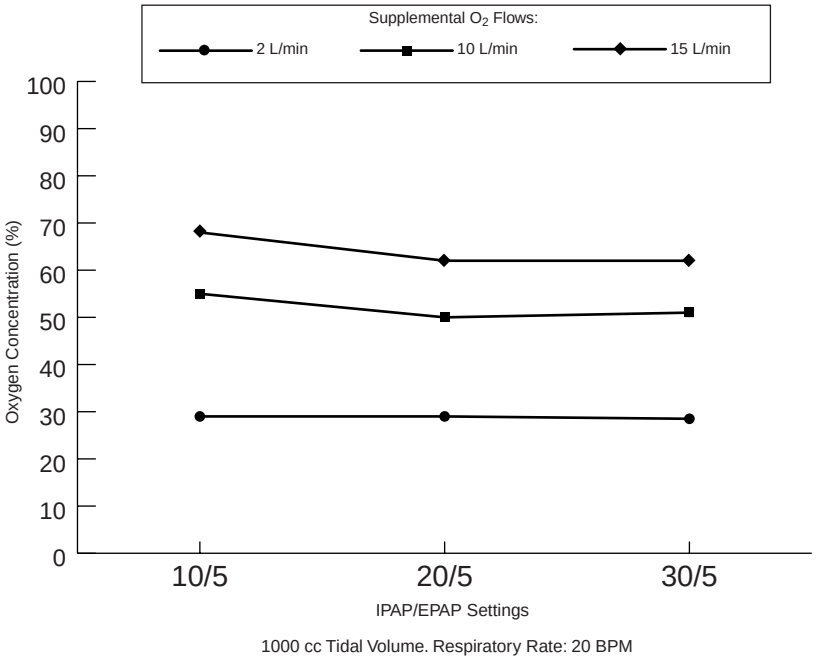


Figure 10-3 Oxygen Concentration for 1000cc Tidal Volume

Chapter 11: Cleaning and Maintenance

11.1 Cleaning the Synchrony

WARNING: To avoid electrical shock, always unplug the Synchrony power cord before cleaning the Synchrony.

CAUTION: Do not immerse the Synchrony in liquid or allow any liquid to enter the enclosure, inlet filter, or any openings.

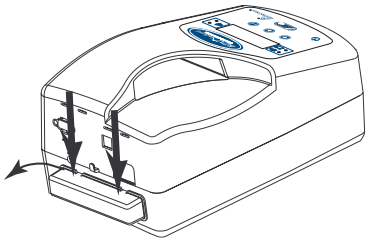
Unplug the Synchrony and clean the front panel and exterior of the enclosure as needed using a cloth dampened with water and a mild detergent. Allow the Synchrony to dry completely before plugging in the power cord.

The mask and tubing should be cleaned daily. For details on cleaning your mask and accessories, refer to the cleaning instructions packaged with the accessories.

CAUTION: Dirty inlet filters may cause high operating temperatures that may affect Synchrony performance. Regularly examine the inlet filters as needed for integrity and cleanliness.

11.2 Cleaning or Replacing the Inlet Filters

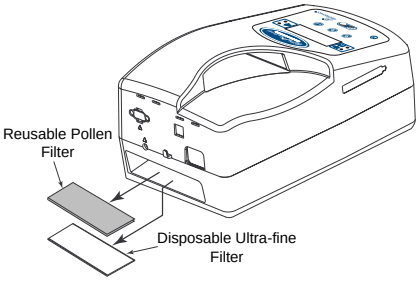
The Synchrony uses two removable filters at the air inlet. The gray foam filter is washable and reusable. The optional white ultra-fine filter is disposable. The gray foam filer should be cleaned at least once every two weeks under normal usage and should be replaced with a new one every six months.



STEP 1 If the Synchrony is operating, stop the Synchrony by pressing the STANDBY key. Disconnect the Synchrony from the power source.

STEP 2 Remove the filter cover by pressing down on the top of the cover to release the tabs, then swinging the cover out from the Synchrony's body.

STEP 3 Remove the filters from the enclosure. The top filter is the reusable gray foam filter. The bottom filter is the optional disposable white ultra-fine filter.



STEP 4 Examine the filters regularly for cleanliness and integrity.

STEP 5 If needed, wash the gray foam filter in warm water with a mild detergent. Rinse thoroughly to remove all detergent residue. Allow the filter to completely dry before reinstalling it. If the foam filter is torn, replace it. (Only Respironics supplied filters should be used as replacement filters.)

STEP 6 If the ultra-fine filter is dirty or torn, replace it.

STEP 7 Reinstall the filters, with the ultra-fine filter on the bottom. Slide the filters into the air inlet at the rear of the Synchrony and push them down into the recess.

CAUTION: Never install a wet filter into the Synchrony. We recommend that you clean the used filter in the morning and alternate use of the two pollen filters provided with the system. This will allow enough drying time for the cleaned filter.

STEP 8 Reinstall the filter cover.

11.3 Maintenance

WARNING: Electrical cords or cables should be periodically inspected for damage or signs of wear.

See the Synchrony Service Manual for recommended periodic maintenance.

Chapter 12: Circuits and Accessories

This chapter details the Respironics-approved breathing circuits and accessories.

WARNING: Refer to each accessory's instruction sheets for the applicable warnings, cautions, and notes.

12.1 Circuit Configurations

WARNING: The Synchrony requires an intentional leak port, either built into the mask or on a separate exhalation device (e.g., Whisper Swivel II, Plateau Exhalation Valve [PEV], or Disposable Exhalation Valve) to remove exhaled air from the circuit. Therefore, specific masks and circuits using an intentional leak port are required for normal operation. The pressurized air from the Synchrony causes a continuous flow of air to exhaust from the leak port to flush the exhaled air from the circuit. The Synchrony should be turned on and the intentional leak port should be checked before using the Synchrony.

The Synchrony is intended for use with Respironics-approved patient circuits. Typical components are:

- bacteria filter (optional)
- 22 mm reusable circuit tubing
- exhalation device
- Respironics patient interface (e.g., mask)
- humidifier (optional)

Additional accessories may be added to the circuit to meet specific needs.

12.2 Circuits and Accessories

—Reusable or Disposable Circuit

Reusable smooth inner lumen circuit tubing, exhalation port.
Disposable smooth inner lumen circuit tubing, exhalation port.

—Circuit Accessories:

6" disposable circuit tubing
18" disposable circuit tubing
72" disposable circuit tubing
O_2 enrichment attachment
bacteria filter

—Synchrony Accessories:

oxygen valve
DC power cord

12.3 Masks, Exhalation Ports, and Related Accessories

—Masks:

Respironics mask with built-in exhalation port or Respironics mask with separate exhalation device.

—Accessories:

disposable headgear
reusable headgear
chin strap
Comfort Flap® mask accessory

WARNING: The PEV option must be enabled if a Plateau Exhalation Valve (PEV) is used.

12.4 Humidifiers

—Respironics Pass-over humidifier
—Respironics H2 Heated Humidifier

12.5 Software

Respironics Encore® and Encore Pro Data Management Software for reading compliance data.

Chapter 13: Operational Verification

WARNING: If the Synchrony system fails to perform within the stated specifications of Chapter 14, have the system serviced by a qualified Respironics-approved service facility.

NOTE: If the backlight is off, the first press of the ▲, ▼, or ↵ key will only turn the backlight on; the normal key action is suppressed until the key is pressed a second time. All procedures assume the backlight is already on.

NOTE: This procedure does not verify performance of the optional Oxygen Valve. If this valve is installed and a performance verification is required, refer to the Synchrony Service Manual.

NOTE: If the ● indicator does not move when you are simulating breaths, press the RAMP key to exit flow limit control.

13.1 S Mode Verification

The operational verification allows the home care provider to verify that the Synchrony is functioning properly. Operational verification should be completed before each new patient setup.

STEP 1 Connect the patient circuit to the Synchrony as described in Chapter 4 of this manual.

STEP 2 Connect a water column or digital manometer to a mask port.

STEP 3 Connect the AC inlet to the Synchrony and connect the AC line to the appropriate power source. The AC power LED should be illuminated.

STEP 4 Press the Standby key to start the Synchrony.

STEP 5 Set the parameters to the following:

- Mode = S
- Bi-Flex = OFF
- IPAP = 20 cm H_2O
- EPAP = 4 cm H_2O
- IPAP Rise Time = 1
- Patient Disconnect Alarm Delay = OFF
- Apnea = OFF
- LowMinVent = OFF

STEP 6 Simulate a breathing pattern by occluding and opening the patient outlet.

- Verify that the ● indicator appears next to the “IPAP” display during the inspiratory phase and appears next to the “EPAP” display during the expiratory phase.
- Verify the IPAP and EPAP pressures displayed on the Synchrony screen agree with the pressures indicated on the manometer.

If you wish to verify the performance of the patient alarms, see Section 13.3.

13.2 S/T Mode Verification

STEP 1 Connect the patient circuit to the Synchrony as described in Chapter 4 of this manual.

STEP 2 Connect a water column or digital manometer to a mask port.

STEP 3 Connect the AC inlet to the Synchrony and connect the AC line to the appropriate power source. The AC power LED should be illuminated.

STEP 4 Press the Standby key to start the Synchrony.

STEP 5 Set the parameters to the following:

- Mode = S/T
- IPAP = 20 cm H_2O
- EPAP = 4 cm H_2O
- Rate = 6 BPM
- Timed Inspiration = 1.5 sec
- IPAP Rise Time = 1
- Patient Disconnect Alarm Delay = OFF
- Apnea = OFF
- LowMinVent = OFF

STEP 6 Simulate a breathing pattern by occluding and opening the patient outlet.

- Verify that the ● indicator appears next to the “IPAP” display during the inspiratory phase and appears next to the “EPAP” display during the expiratory phase.

STEP 7 When you have established an IPAP/EPAP pattern, occlude the patient circuit.

STEP 8 Wait for the Synchrony to establish a breathing pattern according to the settings of Step 5.

- Verify that the ● indicator appears next to the ”Rate” display when the Synchrony initiates a breath.
- Verify the IPAP and EPAP pressures displayed on the Synchrony screen agree with the pressures indicated on the manometer.

If you wish to verify the performance of the patient alarms, see Section 13.3.

13.3 Alarm Verification

STEP 1 Keep the patient circuit and parameter setups as used in the S or S/T verification.

STEP 2 Set the Patient Disconnect Alarm Delay to 15 sec.

STEP 3 Exit to the Monitoring screen. Open the patient circuit to atmosphere.

- Verify that the Patient Disconnect Alarm occurs in 15 seconds.

STEP 4 Press the RAMP key to silence the alarm. Then clear the alarm screen using the ENTER key. Next simulate a breathing pattern by occluding and opening the patient outlet to correct the alarm condition.

NOTE: The red high priority alarm indicator light will appear solid when the alarm condition has subsided. It will take several breaths to correct the alarm condition. The light will remain solid until the alarm has been cleared.

STEP 5 Set the following alarms:

- Patient Disconnect Alarm = OFF
- Apnea = 10 sec

STEP 6 Exit to the Monitoring screen. To ensure that Flow Limit Control is not active, simulate a breathing pattern until the IPAP/EPAP activity indicator **(●)** moves; then occlude the patient outlet.

- Verify that the Apnea Alarm occurs in 10 seconds.

STEP 7 Clear the alarm; set the following alarms:

- Apnea = OFF
- LowMinVent = 20 L/min

STEP 8 Exit to Monitoring screen 2 (to display Minute Ventilation).

STEP 9 Simulate 6 breaths by alternately occluding and opening the patient outlet.

STEP 10 After 6 breaths, alter the breathing pattern to lower the minute ventilation below the alarm setpoint of 20 L/min.

- Verify that the LowMinVent alarm occurs.

STEP 11 Clear the alarm.

STEP 12 While the Synchrony is still operating, disconnect the power cord from the Synchrony.

- Verify that a continuous alarm sounds for at least two minutes.

Adjust the Synchrony to the appropriate patient settings after the Performance Verification and before patient use.

Chapter 14: Specifications

ENVIRONMENTAL

	Operating	Storage
Temperature	41 °F to 95 °F	-4 °F to 140 °F
Humidity	15 to 95% Relative (non-condensing)	15 to 95% Relative (non-condensing)
Atmospheric Pressure	83 to 102 kPa (5600 feet to sea level)	50 kPa to 106 kPa (20000 feet to sea level)

PHYSICAL

Dimensions: 12" L x 7" W x 6" H

Weight: Approximately 6 lb

ELECTRICAL

AC Voltage: 100 to 240 V ~, 50/60 Hz

DC Voltage: 12 V ⎓

AC Current: 1.25 A maximum

DC Current: 5.5 A maximum

Protection against electric shock: Class II

Degree of protection against electric shock: Type BF Applied Part

Degree of protection against harmful ingress of water: Ordinary Equipment, IPX0

Modes of Operation: Continuous

Electromagnetic Compatibility: The BiPAP Synchrony Ventilatory Support System meets the requirements of EN 60601-1-2.

Fuses: There are no user-replaceable fuses.

PRESSURE

Output: 4 to 30 cm H_2O

CONTROL ACCURACY

Parameter	Range	Accuracy
IPAP	4 to 30 cm H_2O**	± 2 cm H_2O*
EPAP	4 to 25 cm H_2O**	± 2 cm H_2O*
CPAP	4 to 20 cm H_2O	± 2 cm H_2O*
Breath Rate	0 to 30 BPM (PA and S/T); 4 to 30 BPM (T)	Greater of 1 BPM or ± 10% of setting when measured over a four minute period.
Timed Inspiration	0.5 to 3.0 sec	± (0.1 + 0.10 of setting) sec
Rise Time	1 to 6	± 25%*
Ventilation Ramp	Disabled, 0.5, 1.0, 2.0, 3.0 cm H_2O per breath	± (0.1 + 0.25 of setting) cm H_2O/breath. Measured over the full duration of the programmed ramp.

* Measured at the patient end of circuit with a Whisper Swivel II exhalation port and no patient flow. Dynamic pressure accuracy is ± 5 cm H_2O measured at the patient end of the circuit with a Whisper Swivel II and varying flow conditions. The range of values correspond to hundreds of milliseconds (e.g., a setting of 4 indicates a Rise Time of .4 seconds).

* Limited to 4 to 20 cm H_2O for IPAP/EPAP when Bi-Flex is enabled.

TRIGGER

Spontaneous Trigger:
—Shape Trigger
—Volume 6 cc above $\dot{V}_{leak}$

Spontaneous Cycle:
—Spontaneous Expiratory Threshold (SET)
—Shape Cycle
—IPAP maximum of 3.0 sec
—Flow Reversal - A flow reversal event causes the machine to cycle to EPAP

ACCURACY OF MEASURED AND CALCULATED PARAMETERS

PARAMETER	ACCURACY
Respiratory Rate	Greater of ±1 BPM or ±10% of reading when measured over a four minute period
Exhaled Tidal Volume	± (25 + 0.15 of reading) ml
Exhaled Minute Ventilation	± (1 + 0.15 of reading) L/min
Leak Rate	± (5 + 0.15 of reading) L/min

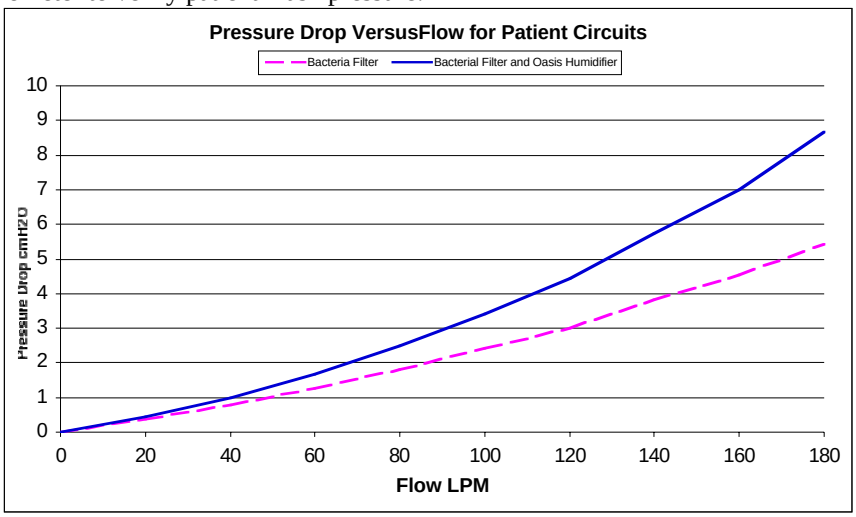
CONNECTOR

The patient interface port is a 22 mm tapered connector.

Pressure Drop Versus Flow for Patient Circuits

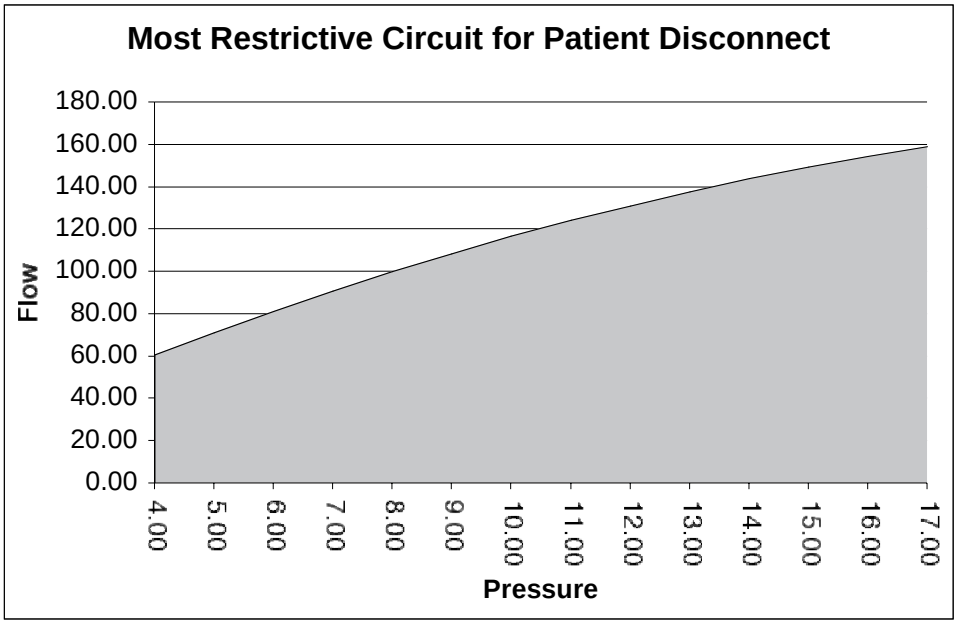
The Synchrony automatically compensates for pressure drops associated with a 6-foot smooth bore tube. Additional pressure drop will occur when restrictive elements are added to the patient circuit. The following graph shows the additional pressure drop when adding: 1. a bacteria filter; 2. a bacteria filter and a Respironics pass-over humidifier.

Note: Always use a manometer to verify patient mask pressure.



Maximum Pressure Drop for Patient Disconnect Alarm

The Patient Disconnect alarm relies on a fixed relationship between the patient pressure settings and the open circuit flow of the patient circuit. The alarm should work properly if your circuit is less restrictive than the circuit parameters shown below.



NOTE: You must verify that the Patient Disconnect Alarm operates properly with the prescribed patient pressures and circuit.

Appendix A: External Modem Requirements

This chapter explains requirements for using an external modem with the Synchrony.

A.1 Serial Cable

The Synchrony is equipped with a 9-pin RS-232 port. The serial cable for connecting the external modem to the Synchrony must be a DTE-to-DCE cable (i.e., “straight-through” cable). This is the serial cable that normally comes with a modem, however, a diagram is shown in Figure A-1 for verification.

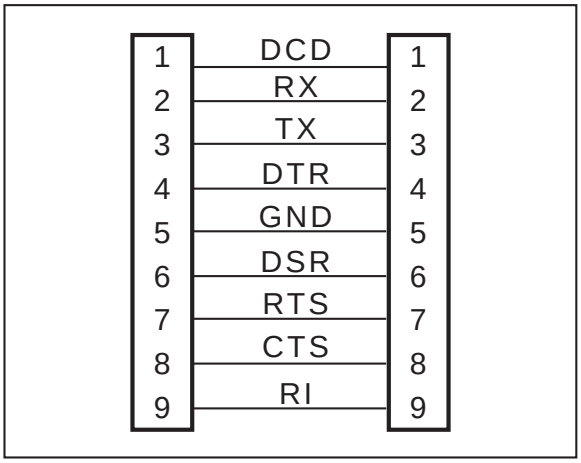


Figure A-1 Serial Cable Requirements

A.2 Modem Commands

The Synchrony makes the following assumptions regarding modem commands:

- The modem must be Hayes compatible and recognize the AT command set.
- The **ATZ[CR]** command will reset the modem, where **[CR]** represents a carriage return (ASCII 13).
- The **ATH0[CR]** command will hang up the modem.
- The escape code sequence is a one-second guard time where no data is sent to the modem followed by the +++ command.

The Synchrony software uses the DTR line on the RS-232 port to aid in hanging up the modem. It is strongly recommended that the external modem be configured to monitor the DTR line. Normally, this is the default operation for the modem. If it is not, you should add the **&D2** option in the modem initialization string.

The Synchrony software requires that modem commands and modem result codes are echoed back to the Synchrony. Normally, this is the default operation for the modem. If not, you should add the **E1**, **X4**, AND **Q0** options in the modem initialization string.

The Synchrony software handles both numerical (short-form) and verbose (long-form) result codes. However, it will only recognize the verbose result codes that contain the following words in English: **OK**, **ERROR**, **CONNECT**, **RING**, **NO CARRIER**, **NO DIALTONE**, **NO DIAL TONE**, **BUSY**, **NO ANSWER**. Normally, the default option for the modem verbose result codes, which is typically configured with the **V1** option. If not, the **V0** option specifies numerical result codes. In either case, it is recommended that you specify this option in the initialization string.

The Synchrony software currently does not handle the answering of incoming calls. Therefore, you should configure the modem by setting the **S0** register to zero (i.e., **S0=0** in the initialization string).

A.3 Example Initialization Strings

The Synchrony requires that you specify two initialization strings. The following recommendations work with U.S. Robotics modems and should work with others:

- Init String 1: **AT&FX4V1E1Q0D2**
- Init String 2: **ATS0=0**

To turn off the modem's speaker, add the **M0** option. The initialization strings would appear as follows:

- Init String 1: **AT&FX4V1E1Q0D2**
- Init String 2: **ATM0S0=0**

Appendix B: Error Codes

This appendix lists the definitions for the displayed error codes (see Section 7.2.2)

ERROR CODE	DEFINITION	ERROR CODE	DEFINITION
1	ERR_SOFTWARE	60	BATTERY_FAILURE_ALARM
2	CPU_FAILURE	61	HIGH_BATTERY_ALARM
3	STACK_OVERFLOW_FAILURE	62	LOW_MIN_VENT_ALARM
4	STACK_UNDERFLOW_FAILURE	63	EXHALATION_PORT_ALARM
5	STACK_RESERVE_FAILURE	64	APNEA_ALARM
6	RAM_FAILURE	65	PATIENT_DISCONNECT_ALARM
7	STUCK_KEY_FAILURE	66	HIGH_PRESSURE_ALARM
8	CORRUPT_RX_MODE_FAILURE	67	LOW_PRESSURE_ALARM
9	CORRUPT_RX_PARM_IN_MODE_FAILURE	68	PROX_LINE_ALARM
10	CORRUPT_RX_PARM_OUT_MODE_FAILURE	69	WAIT_FOR_TRIG_ERR1
11	CORRUPT_ALARM_PARM_FAILURE	70	COMPUTE_MINVENT_ERR1
12	CORRUPT_SYSTEM_DATA_FAILURE	71	COMPUTE_PERCENT_TI_ERR1
13	CORRUPT_MODEM_PARM_FAILURE	72	COMPUTE_BPM_ERR1
14	CORRUPT_USAGE_LOG_DATA_FAILURE	73	COMPUTE_PAT_TRIG_BREATHS_ERR1
15	CORRUPT_SW_VERSION_DATA_FAILURE	74	COMPUTE_TIME_AT_P_ERR1
16	SOFTWARE_CHANGE_FAILURE	75	COMPUTE_TIME_AT_P_ERR2
17	DATA_FLASH_ERASE_FAILURE	76	GET_CALC_PARAM_ERR1
18	DATA_FLASH_WRITE_FAILURE	77	ROM_CRC_FAILURE
19	DATA_FLASH_OVERLAP_PAGE_1_FAILURE	78	VREF_12000_FAILURE
20	DATA_FLASH_OVERLAP_PAGE_2_FAILURE	79	AUDIBLE_ALARM_VCAP_FAILURE
21	DATA_FLASH_OVERLAP_PAGE_3_FAILURE	80	FRONT_PANEL_TEST_STANDBY_KEY_FAILURE
22	DATA_FLASH_OVERLAP_PAGE_4_FAILURE	81	UI_ALARM_QUEUE_FULL_FAILURE
23	BUZZER_SOUND_FAILURE	82	CAL_DATA_CRC_FAILURE
24	LCD_CUST_CHAR_FAILURE	83	AIR_STREAM_OVER_TEMP
25	RED_ALARM_LED_FAILURE	84	AIR_STREAM_UNDER_TEMP
26	YELLOW_ALARM_LED_FAILURE	85	AUDIBLE_ALARM_VOLTAGE_FAILURE
27	GREEN_DC_POWER_LED_FAILURE	86	MOTOR_FAILURE
28	GREEN_AC_POWER_LED_FAILURE	87	DEFAULT_SWITCH_MODEM_HANGUP
29	RTC_NOT_TICKING_FAILURE	88	DEFAULT_SWITCH_MODEM_INIT
30	RTC_BATTERY_LOW_FAILURE	89	EXECUTION_SEQUENCE_FAILURE
31	RTC_DATA_CORRUPT_FAILURE	90	DEFAULT_SWITCH_MODEM_REGAINCONTROL
32	WATCHDOG_FAILURE	91	RESICALC_UNIT_ID
33	GET_THERAPY_LOG_DATA_ERR1	92	DEFAULT_SWITCH_MODEM_ESCAPE_SEQ
34	BREAKPOINT_EXCEPTION_FAILURE	93	CORRUPT_KNOWN_LEAK_DATA
35	BUS_ERROR_EXCEPTION_FAILURE	94	DEFAULT_SWITCH_MODEM_PROCESS_CMD
36	SOFTWARE_INTERRUPT_FAILURE	95	BARO_PRESSURE_FAILURE
37	ILLEGAL_INSTRUCT_EXCEPT_FAILURE,	96	BAD_RESISTANCE_TABLE
38	DIVIDE_BY_ZERO_EXCEPTION_FAILURE	97	DRIFT_TOO_HIGH
39	UNUSED_INTERRUPT_FAILURE	98	DRIFT_HIGH
40	UNINIT_INTERRUPT_FAILURE	99	DRIFT_CRC_FAILURE
41	SPURIOUS_INT_EXCEPTION_FAILURE	100	MAX_RESETS_OVER_TIME
42	HIGH_PRIORITY_THREAD_INACTIVE	101	CORRUPT_ACCESS_KEY_DATA_FAILURE
43	LOW_PRIORITY_THREAD_INACTIVE	102	CORRUPT_TLOG_STORAGE_DATA_FAILURE
44	BACKGROUND_THREAD_INACTIVE	103	INVALID_TEST_CALL
45	FRONT_PANEL_TEST_NO_KEY_FAILURE	104	UNRECOGNIZED_BOARD_REVISION_BY_SW
46	FRONT_PANEL_TEST_UP_KEY_FAILURE	105	BLOWER_ERROR_SIGNAL_FAILED
47	FRONT_PANEL_TEST_DOWN_KEY_FAILURE	106	BLOWER_CURRENT_FAILED_HIGH
48	FRONT_PANEL_TEST_ENTER_KEY_FAILURE	107	BLOWER_CURRENT_FAILED_LOW
49	FRONT_PANEL_TEST_RAMP_KEY_FAILURE	108	BLOWER_RPM_FAILED_HIGH,
50	FRONT_PANEL_TEST_SECRET_KEY_FAILURE	109	BLOWER_RPM_FAILED_LOW
51	LCD_DISPLAY_CTRL_TIMEOUT	110	VALVE_ENABLE_FAILURE
52	LCD_DISPLAY_DATA_TIMEOUT	111	VREF_1250_FAILURE
53	LCD_DISPLAY_READ_TIMEOUT	112	COMPUTE_AVG_LEAK_ERR1
54	ADC_CONVERSION_FAILURE	113	BACKGROUND_THREAD_DEFAULT_SWITCH
55	SYS_DATA_BAD_RANGE_FAILURE	114	COPY_FLASH_FUNCTIONS_FAILURE
56	LOSS_AC_OPER_DC_POWER	115	UI_EVENT_QUEUE_FULL_FAILURE
57	MOMENTARY_LOSS_OF_POWER	116	RISE_RATE_RANGE_FAILURE
58	BATTERY_IN_USE_ALARM	117	PRESSURE_RANGE_FAILURE
59	LOW_BATTERY_ALARM	118	IRFLOW_STUCK_SENSOR

ERROR CODE	DEFINITION
119	PATM_STUCK_SENSOR
120	PP_STUCK_SENSOR
121	PV1_STUCK_SENSOR
122	PV2_STUCK_SENSOR
123	ERASE_SECTOR_FAIL
124	WRITE_FLASH_FAIL
125	UNRECOGNIZED_ACCESS_KEY_VERSION
126	PV1_PV2_SENSOR_FAILURE
127	DATA_LOGGING_ERR1
128	SCAN_EVENTS_ERR
129	LOG_INITIAL_VALUES_ERR1
130	LOG_EVENT_ERR1
131	DATA_FLASH_ERR
132	SYS_PT_ALARM_LOG_CHECKSUM_ERR
133	CORRUPT_SYS_ALARM_LOG_DATA_FAILURE
134	CORRUPT_PT_ALARM_LOG_DATA_FAILURE
135	BLOWER_DEFAULT_ERR1
136	BLOWER_OFF_CURRENT_HIGH
137	UNRECOGNIZED_CAL_VERSION_BY_SW
138	UNIT_TYPE_FAILURE
139	TLOG_WRITE_QUEUE_BAD_DATA
140	UNEXPECTED_WATCHDOG_RESET
141	VALVE_DEFAULT_ERR1
142	DRIFT_DEFAULT_ERR1
143	UI_HIGH_PRIORITY_ALARM_TEST
144	UI_2_HIGH_PRIORITY_ALARM_TEST
145	UI_MEDIUM_PRIORITY_ALARM_TEST
146	UI_2_MEDIUM_PRIORITY_ALARM_TEST
147	UI_LOW_PRIORITY_ALARM_TEST
148	UI_2_LOW_PRIORITY_ALARM_TEST
149	LOW_PRESSURE_SUPPORT_ALARM
150	INVALID_DRIFT_INDEX_AT_CAL
151	INVALID_TCAL_AT_CAL
152	INVALID_MODE_IN_CURRENT_MODEL
153	UNSUPPORTED_FEATURE_SET
154	LOW_TIDAL_VOLUME_ALARM
155	VTE_TARGET_SETPOINT_ZERO
156	ERR_BRMODEL_MAX_AMPLITUDE
157	ERR_RAMP_DEFAULT1
158	INVALID_ALARM_CODE

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Limited Warranty

Respironics, Inc. warrants that the BiPAP Synchrony System shall be free from defects of workmanship and materials and will perform in accordance with the product specifications for a period of two (2) years from the date of sale by Respironics, Inc. to the dealer. If the product fails to perform in accordance with the product specifications, Respironics, Inc. will repair or replace – at its option – the defective material or part. Respironics, Inc. will pay customary freight charges from Respironics, Inc. to the dealer location only. This warranty does not cover damage caused by accident, misuse, abuse, alteration, and other defects not related to material or workmanship.

Respironics, Inc. disclaims all liability for economic loss, loss of profits, overhead or consequential damages which may be claimed to arise from any sale or use of this product. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty is given in lieu of all other express warranties. In addition, any implied warranties—including any warranty of merchantability or fitness for the particular purpose—are limited to one year. Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

To exercise your rights under this warranty, contact your local authorized Respironics, Inc. dealer or contact Respironics, Inc. at:

1001 Murry Ridge Lane
Murrysville, Pennsylvania 15668-8550
1-412-387-4000

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